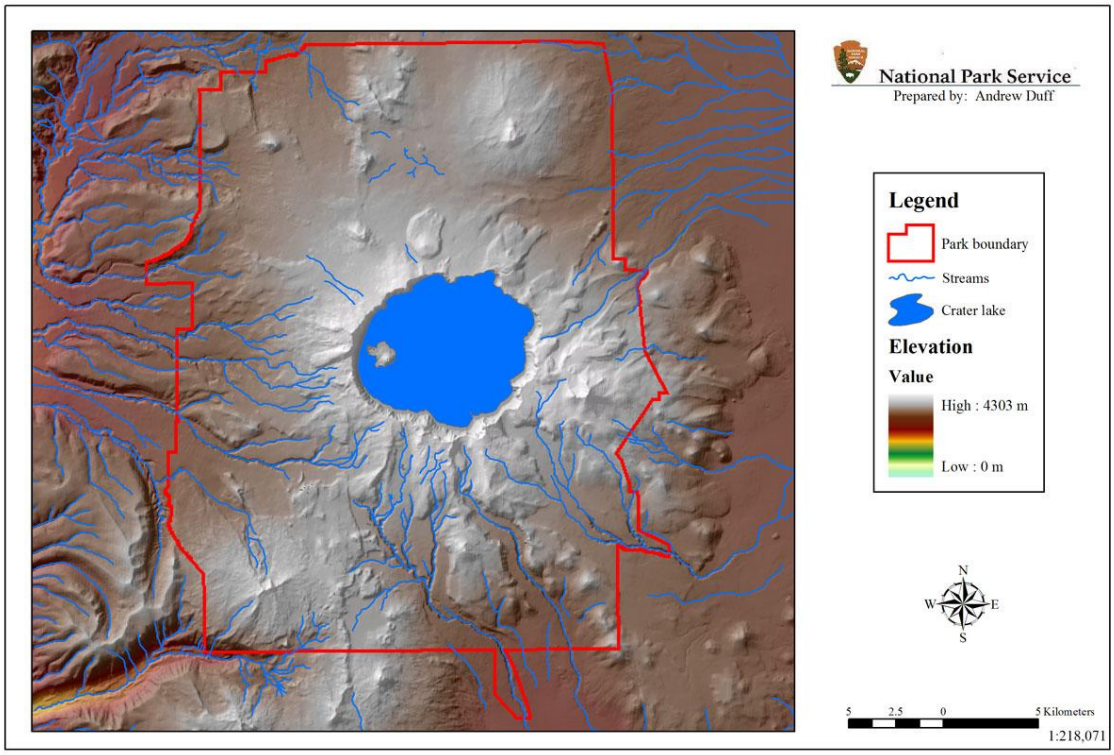
APPENDIX A: PARK NATURAL RESOURCE PROFILES

1.0 INTRODUCTION

This appendix provides a general overview of each Park Unit. Far more is known about many park features, and additional information is available from the Klamath Network and individual parks. Special habitats, and Federally listed threatened, endangered, and other species of special concern in occurring in each park are described in Appendix E. Air quality and water quality issues are described in greater detail in Appendices H and F respectively.

1.1. CRATER LAKE NATIONAL PARK



A. General Description

Location, Size, and Elevation

Crater Lake National Park is located in southwestern Oregon on the divide of the High Cascades. It lies in an area with a long history of volcanic and glacial activity, extending from Lassen Peak in northern California northward into Canada. The park encompasses 73,775 hectares (182,304 acres), and is bounded by the Winema, Umpqua, and Rogue River National Forests. A small area of private land borders the southeast corner of the park. The park contains varied topography that rises from 1,219 meters (4,000 feet) in Red Blanket Canyon on the park's southwest corner to 2,720 meters (8,926 feet) at the summit of Mount Scott.

Crater Lake occupies the collapsed caldera of the once majestic Mount Mazama, and is the primary visitor attraction of the park. The lake itself is 7 to 9.5 kilometers (4.5 to 6 miles) across, has 32 kilometers (20 miles) of shoreline, and a surface area of 5,339 hectares (13,192 acres). With a maximum depth of 588 meters (1,947 feet), Crater Lake is the seventh deepest lake in the world and the deepest in the United States.

Park Purpose and History

Crater Lake National Park was established by President Theodore Roosevelt on May 22, 1902 (32 Stat. 202) as "an area of two hundred and forty-nine square miles...dedicated and set apart forever as a public (park) or pleasure ground for the benefit of the people of the United States, to be known as 'Crater Lake National Park.'" The act further states "that the reservation established by this act shall be under the control of the Secretary of the Interior, whose duty it shall be to establish rules and regulations and cause adequate measures to be taken for the preservation of the natural objects within said park." In addition, the act requires that adequate measures shall be taken for "the preservation of the natural objects...the protection of the timber...the preservation of all kinds of game and fish" and "that said reservation shall be open...to all...scientists, excursionists, and pleasure seekers."

There are several historic sites present in the park, which serve as a reminder of an historic activity or an event. These sites exemplify rustic architecture and may have roads, trails, campgrounds and site features eligible for special management related to their historic value. Some historic sites have been evaluated either singly or as a group for listing in the National Register of Historic Places.

Climate

Crater Lake is near the midpoint of the Sierra Cascade Mountain province of the Pacific mountain system. The park is influenced by Pacific Ocean weather, and the majority of storm fronts that pass the north Pacific Coast each winter result in precipitation at Crater Lake, providing the main source of water for the Lake. Precipitation averages 1778 mm (70 inches) per year at park head, with the majority of precipitation as snow. Crater Lake records some of the heaviest snow in the United States each winter, with annual totals averaging over 13 meters (520 inches). Summer weather is generally mild with clear skies except for occasional afternoon thunderstorms, which are a primary ignition source for wildfires.

B. Biological Resources

The high biotic integrity of the Park is reflected by the fact that there are four research natural areas within Crater Lake National Park. Each area represents outstanding habitats of the Oregon Cascades Province, as defined in the Oregon Natural Heritage Program Plan (2003). These areas include: The Sphagnum Bog, Llao Rock, Pumice Desert, and Desert Creek.

Vegetation and Flora

The vegetation and flora of Crater Lake National Park is typical of that found throughout the Southern Cascades. Generally, the vegetation of the region reflects a mosaic of mixed conifer forested areas and open non-forested areas. Climate, topography, soil development, and fire history all affect the composition and distribution of existing plant communities. Crater Lake National Park is dominated by conifer forests that have evolved under the influence of fire. Varying fire regimes over the landscape, over time, have resulted in a multitude of plant communities in various stages of ecological succession. Because of this natural diversity, the park is regarded by many as a sanctuary for native forest and meadow communities, with limited introductions of non-native species. Approximately 20,250 hectares (50,000 acres) of late seral forest exist throughout the park.

From generally lower to higher elevations, the following vegetation types can be distinguished: ponderosa pine forests, lodgepole pine, subalpine forests (hemlock and whitebark pine, or just whitebark pine, pumice desert, and alpine fell fields. Ponderosa pine forests, which typically occur below about 1800 m (6,000 feet), may grow as relatively pure stands of ponderosa (*Pinus ponderosa*) or as mixed stands with white fir (*Abies concolor*), sugar pine (*Pinus lambertiana*), incense cedar (*Calocedrus decurrens*), and Douglas-fir (*Pseudotsuga menzesii*). Lodgepole pine (*Pinus contorta*) may occur at a variety of elevations, often in dense, pure, even-aged stands dating back to a fire. The subalpine forest, at the upper limit of the coniferous forest, is dominated by whitebark pine (*Pinus albicaulis*) and mountain hemlock *(Tsuga mertensiana)*. Near timberline, the alpine meadows and fell fields are well known for colorful wildflowers. The pumice desert north of the Crater Lake caldera rim, is an area where harsh abiotic conditions limit plant growth. There are but a few small lodgepole pines amid the sparse subalpine vegetation. Patches of montane chaparral dominated by greenleaf manzanita (*Arctostaphylos patula*), snowbrush ceanothus (*Ceanothus cordulatus*) also occur in conifer forest zones.

There are 20 plant species known to exist within the park that are considered rare, with status as state-listed rare species; none are federally listed (Appendix E). They are all herbaceous, except for white stem gooseberry (*Ribes inerme var klamathense*). Most of the rare plants occur in relatively open high elevation habitats:

Fauna

Crater Lake National Park is home for populations of elk (*Cervus canadensis nelsoni*), mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), coyote (*Canus latrans*), pine marten (*Martes americanus*), porcupine (*Erethizon dorsatum*) and several species of small mammals and rodents. Periodic sightings of black bear (*Euarctos americanus*), weasel (*Mustela frenata*), raccoon (*Procyon lotor*) and mountain lion (*Felis concolor*) are reported in the summer months. Rare sightings of federally listed gray wolf (*Canis lupis*) and wolverine (*Gulo gulo luteus*) have been reported within the park throughout the 1980s but these sightings have not been confirmed. Several species of

animals that were historically found in the park have not been reported for many years. Other rare mammals believed to be in the Park include the fisher (*Martes pennnanti*) and marten (*Martes americana*).

Bull trout are the only native fish known to inhabit Crater Lake National Park today, and Sun Creek is the only stream known to contain bull trout. Non-native brook trout (*Salvelinus fontinalis*) were introduced into the park beginning in the 1920's. Brook trout were stocked into all waters within the park thought to support fish, with the exception of Crater Lake itself. Rainbow trout and Kokanee Salmon were historically stocked into Crater Lake; these fish can still be found in the Lake today.

Characteristic bird communities of subalpine, mountain hemlock, and ponderosa pine forests thrive at Crater Lake National Park. The most conspicuous, the Clark's Nutcracker (*Nucifraga columbiana*), which has an intimate relationship with the white bark pines, is common. The related and similarly raucous Stellar's Jay (*Cyanocitta stelleri*), and Gray Jay (*Perisoreus canadensis*), are also conspicuous, often visiting campgrounds and picnic grounds for handouts. Well-known songbirds of medium and high mountain areas are also common (e.g. Mountain Bluebird (*Sialia currucoides*), Mountain Chickadee (*Parus gambeli*), Red-breasted Nuthatch (*Sitta canadensis*), Townsend's Solitare (*Myadestes townsendi*), Yellow-rumped Warbler (*Dendroica coronata*), Rosy Finch (*Leucosticte tephrocotis*), Pine Siskin (*Spinus pinus*), Dark-eyed Junco (*Junco hyemalis*), American Robin (*Turdus migratorius*), and Western Tanager (*Piranga ludoviciana*)). Predatory species most common are Great Horned Owls (*Bubo virginianus*), Red-tailed Hawks (*Buteo jamaicensis*), and Kestrels (*Falco sparverius*). A variety of woodpeckers and sapsuckers occur in the park. Greatly enhancing overall bird diversity are mergansers and cormorants, which dive for fish in the lake, as well as other species that use the lake or lakeshore (Spotted sandpiper (*Actitus macularia*), California Gull (*Larus californicus*)).

There are 15 rare birds that can be found in the park, including raptors such as the Bald Eagle (*Haliaeetus leucocephalus*), Peregrine Falcon (*Falco peregrinus anatum*), Northern Spotted Owl (*Strix occidentalis caurina*), Great Grey Owl (*Strix nebulosa*). There are also Lewis', Three-toed, Black-backed, and White-headed Woodpeckers (*Melanonerpes lewis, Picoides acticus, P. albolarvatus, P. tridactylus*), Mountain Quail (*Oreortyx pictus*)

The herptofauna of Crater Lake NP is characterized by several unusual species. Four state-listed species occur (Appendix E): *Sceloporus graciosus graciosus* (Northern sagebrush lizard), *Taricha granulosa mazamae* (Crater Lake newt), *Ascaphus truei* (Tailed frog), *Rana cascadae* (Cascade frog). Spotted frogs (*Rana pretiosa*) and the rubber boa (*Charina bottae*).

C. Earth and Water Resources

The stratovolcano landform known as Mt. Mazama, and associated pumice deposits, cinder cones, and lava flows make up the majority of Crater Lake National Park. This volcanic landscape, along with Crater Lake itself and the surrounding caldera features, provide the park with its unique and interesting scenery. The park's volcanic landscapes

exert a strong influence on terrestrial ecosystem properties and are internationally recognized as a valuable resource for scientific study.

The National Park Service began a ten-year limnological studies program on Crater Lake in 1982 because of indications that lake clarity might be declining. These associated studies concluded that the lake was pristine except for the introduction of non-native fish. No unidirectional or exponential change was detected for any lake characteristics. Although the possibility of subtle long-term changes in the lake could not be dismissed, researchers regarded such changes to be too subtle for detection over a time scale represented by the available data. The lake ecosystem was judged to be a complex and dynamic system with considerable seasonal and annual variation.

Studies that have documented physical, chemical, and biological characteristics of streams, ponds, and wetlands in the park have generally considered these systems to be pristine except for the introduction of non-native fish and some short-term impacts from park facilities such as isolated sewage spills and chemical discharge associated with the park maintenance yard. Many of these studies were limited in scope, sample size, and duration, and much of this aquatic inventory data is not park-wide or it is outdated.

D. Resource Management Concerns

Atmospheric/Meteorological Resources

Scientists from U.C. Davis, monitoring air quality with IMPROVE particulate monitoring instruments have found that the air at Crater Lake National Park is representative of one of the cleanest airsheds in the United States. Crater Lake National Park is designated a Class I airshed. Potential sources of anthropogenic impacts to air quality include agricultural field and forestry slash burning, human-ignited prescribed and wildland fires, and air-borne pollutants from local and distant urban and industry areas.

Geologic Features

The most significant disturbance to geologic features in the park has been road construction. The initial park road system (approx. 66 miles) was completed in 1940. Damages include scars to the landscape in the form of old quarry sites, road cuts, and debris. Road improvement projects, including the paving of Rim Drive in 1957, realignment of Highway 62 in 1963, and removal of turnouts along Munson Valley road in 1996 have resulted in additional impacts. The Pumice Desert is a unique landform that is continually threatened by illegal off-road vehicle impacts that result in unsightly tracks, impacts to sparse vegetation and possibly changes in vegetative succession. Both physical and visual resource values are at risk from this type of human induced damage.

Fisheries Resources

Sun Creek flows into the Klamath River Basin. Bull trout in the Klamath River Basin were listed as “threatened” under the Endangered Species Act by the U.S. Fish and Wildlife Service in June 1998. The park initiated an aggressive bull trout restoration

project in 1991 to remove exotic brook trout from Sun Creek and restore the native population of bull trout.

Vegetative Resources

Fire suppression and historic logging activities have altered forest structure and species composition throughout portions of the park and surrounding areas. The primary concern is in the showcase stands of ponderosa pine found in the low elevation, mixed conifer forests. Within these stands, white fir (*Abies concolor*) and other shade-tolerant species have grown to such densities that ponderosa pine (*Pinus ponderosa*) seeds will not germinate and sprout. Successful regeneration of new pines may require canopy opening through fire or insect related mortality. In areas of high tree density, all of the pine species and Douglas-fir (*Pseudotsuga menzesii*) are subject to bark beetle infestation and damage.

During the past 100 years, a number of non-native plant species have been introduced into Oregon and other western states. Many of these plants are from environments similar to those found in this region and, in the absence of their natural limiting agents, are able to share or dominate the habitats of native plants. Some non-native plants found along roadways include common mullein (*Verbascum thapsus*) and knapweed (*Centaurea* spp.), yet little is known about the overall abundance, distribution, and population dynamics of non-native plant species within Crater Lake National Park. It is believed that spotted knapweed (*Centaurea maculata*) could become a serious problem.

Several native and one exotic plant pathogen are known to exist in Crater Lake National Park. Surveys by the US Forest Service indicate that mortality from the exotic fungal pathogen, white pine blister rust (*Cronartium ribicola*) has occurred in whitebark pine (*Pinus albicaulis*) stands on Watchman Peak and Wizard Island. Additionally, mistletoes and root rot diseases are common in the mixed conifer stands of the Panhandle area.

Faunal Resources

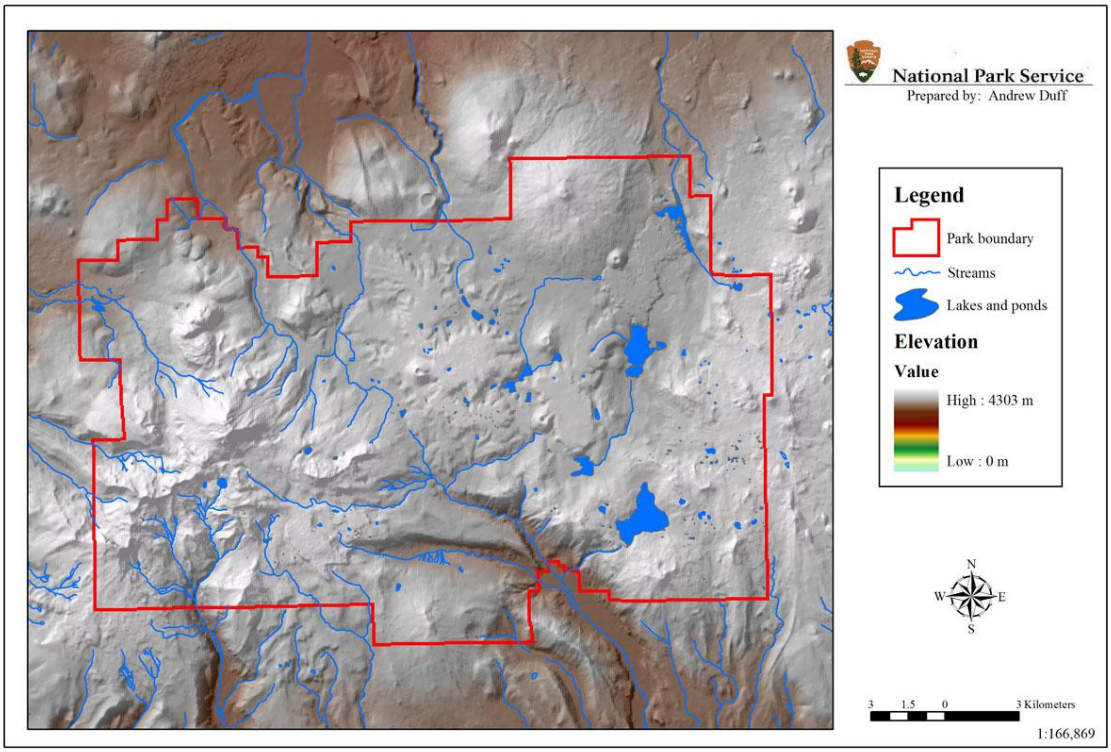
In 1947, O.L. Wallis completed a comprehensive inventory of mammals of Crater Lake National Park. Since that time, the combination of widespread logging and suppression of natural fires has affected the natural forest stands surrounding the park. Such changes may have altered wildlife distribution, abundance, and use of habitat as existed prior to the park's establishment. Without up-to-date information about the status and health of faunal populations found in the park and surrounding area, managers cannot comprehend the state of the park’s faunal communities and take appropriate management action.

Transboundary Issues

Fifty years ago, there was little difference in the integrity of the landscape between national forest and national park lands. Increased harvest and consumptive and recreational use as well as differences in agency policies (e.g. fire management) on the surrounding national forests have led to dramatic changes to Crater Lake's view sheds

and terrestrial ecosystem function. The effects of these changes may increase as these management activities continue.

1.2. LASSEN VOLCANIC NATIONAL PARK



A. General Description

Location, Size, and Elevation

Lassen Volcanic National Park is located in northeastern California in portions of Lassen, Plumas, Shasta, and Tehama counties. The park is about 50 miles (80 kilometers) east of both Red Bluff and Redding, and is within a day's drive of two major California metropolitan centers, the Sacramento and San Francisco Bay areas. Three biogeographic regions come together in Lassen Volcanic National Park: the southern Cascades, the northern Sierra Nevada Mountains, and the Basin and Range Province.

The park encompasses 43,047 hectares (106,372 acres) and is almost completely surrounded by National Forest land (Lassen National Forest). Several small sections of private land adjoin the park boundary in Mill Creek, Spencer Meadow, Willow Creek, Warner Valley, and Lost Creek. The park's area includes 31,963 hectares (78,982 acres) of designated wilderness.

Elevations range from 1,585 meters (5,200 feet) in the southeast near Warner Valley to 3,187 meters (10,457 feet) at the summit of Lassen Peak, a difference of 1,602 meters (5,257 feet). Topography within the park varies greatly with rugged, volcanic mountain peaks in the western section, a lava plateau in the east, deep glaciated valleys in the south, and peaks and ridges of lava modified by erosion in the north.

Park Purpose and History

Lassen Volcanic National Park was established by an Act of Congress on August 9, 1916 "for recreation purposes by the public and for the preservation from injury or spoliation of all timber, mineral deposits and natural curiosities or wonders within said park and their retention in their natural condition...and provide against the wanton destruction of the fish and game found within said park and against their capture or destruction...." Incorporated into the park were Cinder Cone and Lassen Peak National Monuments, which were established by Presidential Proclamations (No. 753 and 754) on May 6, 1907 as part of the Lassen Peak Forest Reserve (established on June 5, 1905 by Presidential Proclamation). In 1972, Congress designated 75 percent of the park (31,964 ha) as the Lassen Volcanic Wilderness.

Lassen Volcanic National Park is an outstanding example of a dynamic geologic landscape and is of unquestioned national significance. Lassen Peak erupted over a six-year period between 1914 and 1921. Preserved within the park is the site of the most recent volcanic eruption within the continental United States, prior to the Mount Saint Helens eruption in May 1980. Lassen Peak is one of the largest plug dome volcanoes in the world.

The cultural resources of the park are diverse and reflect a long history of human activity. The archeological record extends at least 4,000 years into prehistory, with archeological sites ranging from major summer villages to temporary camps to lithic workshops. In general, the high elevation of much of the park excluded year-round occupation by prehistoric populations. Nevertheless, parklands were important for hunting game and gathering vegetal foods for subsistence by three different ethnographic peoples – Maidu, Yana/Yahi, and Atsugewi.

Historic resources are also an important element of the cultural resources of the park. The Nobles Emigrant Trail, established in the mid-19th century, played a critical role in the westward migration of early settlers. A portion of this trail crosses the full width of the north end of the park. Euro-American settlements are also represented in the park at Drakesbad, in the Warner Valley, where the first sheep herding in the region occurred and an early resort was established.

Climate

There is considerable variation in climate with the seasons and elevations. Typically, summers are cool and winters are cold with heavy snowfall. Mean annual high temperatures ranges from -6°C (21°F) at high elevations in winter to 27°C (81° F) at lower elevations during the summer months. Annual average precipitation, mostly in the form of snow, ranges from 1346 mm (53 inches) in Mineral (just outside the park at 1478 meters (4,850 feet) in elevation) to 1778 mm (70 inches) at higher elevations (above 2113 meters (7,000 feet)). Deep, late-lying snows typify the higher elevations of the park. In summer, occasional thunderstorms add additional summer moisture, particularly at higher elevation and towards the eastern edge of the park.

B. Biological Resources

Lying at the confluence of the Cascade Range, the Sierra Nevada and the Great Basin Province, Lassen Volcanic National Park contains a variety of outstanding biotic systems. An overlap of plant species commonly associated with each province combined with the variety of geologic formations and textural compositions of lava contribute to a high diversity of native plants and animal communities.

Vegetation and Flora

Four general vegetation types cover most of the park from lower to higher elevations: yellow pine forests, red fir forests, subalpine forests, and alpine fell fields. Yellow pine forests, which typically occur below about 1800 m (6,000 feet), may grow as relatively pure stands of ponderosa (*Pinus ponderosa*) and/or Jeffrey pine (*Pinus jeffreyii*) or as mixed stands with sugar pine (*Pinus lambertiana*), white fir (*Abies concolor*), incense cedar (*Calocedrus decurrens*), and Douglas-fir (*Pseudotsuga menzesii*). Red fir forests are widespread between 1800 – 2600 m (6,000 - 8,500 feet) and are characterized by mixtures of red fir (*Abies magnifica* var. *shastensis*) lodgepole pine (*Pinus contorta*), Jeffrey pine, western white pine (*Pinus monticola*), and mountain hemlock (*Tsuga mertensiana*). The subalpine forest, at the upper limit of the coniferous forest, is dominated by whitebark pine (*Pinus albicaulis*) and mountain hemlock. These two species are highly weather-resistant and grow at elevations as high as about 3,000 m (10,000 feet). Near timberline, the alpine meadows and fell fields are well known for colorful wildflowers.

Patches of montane chaparral dominated by greenleaf manzanita (*Arctostaphylos patula*), snowbrush ceanothus (*Ceanothus cordulatus*), or pinemat manzanita (*Arctostaphylos nevadensis*) cover approximately ten percent of the park. Most of these shrub fields established after high intensity fires and are gradually being recolonized by conifers. Willow, alder, and meadow vegetation line many of the stream courses, and aspen is found in several moist riparian zones and upland habitats throughout the park. Although these communities account for a relatively small portion of the park, they are very high in native plant and animal diversity and are considered keystone habitats. A large area of the park is rocky and relatively devoid of vegetation. Volcanic eruptions of Lassen Peak in 1914 to 1915 destroyed over 19 square kilometers of forest. The successional process of reforestation is now taking place.

The majority of park land still contains native vegetation complexes; however, most communities have been altered directly or indirectly to some degree by human-caused alterations in natural disturbance regimes. A comprehensive study entitled “Vegetation Dynamics and Change in Lassen Volcanic National Park” was completed by Taylor (1997). This study documents the effects of nearly 100 years of fire suppression and a long history of cattle and sheep grazing in the park. Most notable is the dramatic decline in fire frequency over the past 100 years resulting in an increase in forest density, fuel load, and late seral conifers such as white fir. These changes have been most pronounced

in the lower elevation yellow pine forests where historic fires were most frequent. High densities of white fir have likely triggered increased insect and disease mortality as well. Changes in red fir dominated forests have been less dramatic at the stand level where pre-settlement fires were less frequent. However, the historically complex landscape mosaic has become more homogenous because forest patches of different age and size classes have converged over time resulting in considerably fewer early seral and shrub patches today.

Another human impact addressed in Taylor's report is heavy sheep and cattle grazing in the late 1800's and early 1900's. This grazing reduced or eliminated the herbaceous cover in meadows and riparian areas and facilitated the rapid establishment of dense coniferous and shrub communities. Many meadows are much smaller today than historically and some have been completely overgrown with woody vegetation.

Human developments and transportation corridors have also greatly facilitated the introduction and spread of several non-native plant species throughout the park (NPS 1998). Many non-native plants have the potential to rapidly invade new areas and permanently displace native biota. Because this process is often facilitated or exacerbated by human caused disturbances (both historic and current), management and control of exotic plants in problem areas has become a high priority for the park.

Lassen Volcanic National Park contains several rare and important habitats. In particular, whitebark pine and upland quaking aspen woodlands are found in much higher proportions within the park than the surrounding region. These areas serve as important plant and wildlife habitats and may be especially valuable at the landscape level due to their limited regional distribution. There are no federally listed plant species within the park. However, there are at least twenty-three special status plant species found within the park according to the California Native Plant Society. Almost all of Lassen's special status plants are found in the high elevation subalpine zone. Appendix E lists Lassen's rare plants.

Fauna

Approximately 270 native species of terrestrial and aquatic vertebrates have been recorded in the Lassen Volcanic National Park area, including 56 mammals, 190 birds, and 18 amphibians and reptiles. However, the park lacks basic data on the distribution and abundance of most species and the impacts of human activities on the park's native wildlife communities.

Mammals such as rabbits (*Lepus*, *Sylvilagus*), marmots (*Marmota flaviventris*), martens (*Martes americana*), and skunks are abundant. Beavers (*Castor canadensis*) are expanding into park streams on the southern boundaries that are shared with Lassen National Forest and private ranches, and into the Hat Creek drainage in the northern part of the park. Bears are seen quite frequently. Blacktail deer (*Odocoileus hemionus*) are abundant during summer months, migrating to lower elevations during winter months. Small rodents, in particular, are very abundant in the park and appear to occur throughout

all terrestrial habitats. As a group, these mammals represent both significant herbivores and a significant prey base. Most are habitat specialists and are highly sensitive to habitat changes wrought by succession and fire. Almost 50 percent of all mammal species known to occur in the park are rodents.

Forest carnivores known or suspected to occur in the park include Mustelids (marten, fisher (*Martes pennanti*), wolverine (*Gulo luscus*), ermine (*Mustela erminea*), long-tail weasel (*M. frenata*), mink (*M. vison*), badger (*Taxidea taxus*), and two species of skunks), Canidae (coyote (*Canus latrans*), red fox (*Vulpes fulva*), and gray fox (*Urocynon cinereoargenteus*)), Felidae (bobcat (*Lynx rufus*) and mountain lion (*Felis concolor*)), and Procyonidae (raccoon (*Procyon lotor*) and ringtail (*Bassariscus astutus*). Preliminary photographic bait station inventories done by Resource Management staff in 1995 and 1996, and camera surveys associated with on-going red fox studies have detected several species of forest carnivores including pine marten (common), red fox, gray fox, coyote, and long-tail weasel.

Eight species of bats are known to use the park. Because the features more commonly associated with day roosts, hibernacula, and maternity colonies (such as significant lava tubes, caves, or abandoned mine shafts) are largely absent from the park, bat populations here probably have close habitat ties with late successional old growth forest stands where they roost beneath loose bark or in cavities resulting from tree decay, lightning strike, or woodpeckers. According to the Sierra Nevada Ecosystems Report (Graber 1996), an abundance of large old trees and snags associated with old growth forests are very important to viable populations of several *Myotis* species. A total of five *Myotis* species are classified as US Fish and Wildlife Service Species of Concern. Of those, three are known to occur within the park, while the other two are suspected to occur here.

Several mammal species are known to have been extirpated from the park, including grizzly bear (*Ursus chelan*), gray wolf (*Canus lupus*), and mountain bighorn sheep (*Ovis canadensis*). A bighorn reintroduction program was attempted in this area in the 1970's but failed due to a disease outbreak.

For its relatively small size, Lassen has a reasonably high avian diversity within its boundaries. According to the park's bird checklist, approximately 190 species have been recorded in the park, and half of those are known to breed here (Hatch 1982). Songbirds as a group are of special interest because populations of many species are declining throughout the Sierra Nevada. Eighteen bird species in the region are declining or likely declining. All 18 of these species plus half of the "Species of Concern" (as listed by the California Partners in Flight program) occur within the park. Results from a recent study (King et al. 1998) found that some areas of the park (e.g. Drakesbad Meadows and Warner Valley) serve as important breeding habitat for several songbird species that have very low productivity elsewhere but appear to be highly productive here.

Several species of salamanders, frogs, and lizards, one toad, and one skink are known to be present in the park. Snakes include several species of garter snakes and the rubber boa (*Charina bottae*). One rattlesnake species *(Crotalus viridus)* has been sighted occasionally

in the Butte Lake area. The park's list of amphibians and reptiles undoubtedly has large knowledge gaps. It is estimated that as many as 25 percent of the species that are likely to be present within the park have not been documented.

Recent surveys in the park indicate one of the park's amphibians, the Cascades frog (*Rana cascadae*), which was until the mid-1970s considered abundant throughout the park, has been reduced to one very small relict population that does not appear to be reproducing. It is unknown whether this rapid decline is the result of natural processes (because the frog is at its southern range limit in the park and hence may be more susceptible to natural changes in climate and environment) or human-caused habitat deterioration.

At number of species in the park merit special state and/or federal status due to population and habitat declines throughout their range (Appendix E). The Bald Eagle is the sole animal on the Federal list of Threatened and Endangered animal species to occur within the park. One previously federally listed bird, the Peregrine Falcon, was recently removed from the list, and the Bald Eagle will likely follow suit, also because of successful recovery efforts. Both birds are state-listed. A single pair of Bald Eagle nests near Snag Lake, apparently alternating with other nest sites inside or outside the park. Nesting and fledging success of this pair is monitored annually as part of a comprehensive, statewide effort to track eagle recovery. Hunting territory for this pair comprises most of the eastern half of the park. Though no nesting Peregrine Falcons have ever been detected in the park, in the late summer and early fall these birds are sometimes seen in the high elevations of the eastern part of the park, presumably hunting in response to an upslope post-breeding shift in prey species (Baldridge et al 1980).

Three park bird species are currently being considered for federal listing. These are: Willow Flycatcher *(Empidinox traillii*), of the western subspecies group, Northern Goshawk (*Accipiter gentiles*), and California Spotted Owl *(Strix occidentalis)*. Recent studies by the Point Reyes Bird Observatory found that a 2.5 km^2 montane meadow in Warner Valley on the park's south boundary contained one of the state's most significant breeding populations of willow flycatcher (King et al. 1998). Northern Goshawk and California Spotted owl have been shown to depend on park habitat, but the full extent is not known (Blakesley and Noon 1999, Richter 1998). Two California-listed endangered species, Willow Flycatcher and Great Grey Owl (*Strix nebulosa*), occur or have occurred within the park. The only confirmed sighting of great grey owl occurred near the Bumpass Hell Trail in 1956.

Very little is known about native fish species in Lassen. It is assumed, though not confirmed, that rainbow trout are native to Manzanita Lake. Non-sport species that are native to northern California, and recorded from Lassen Park, include the speckled dace (*Rhinichthys osculus*), Lahontan redside (*Richardsonius egregious*), tui chub (*Siphateles bicolor*) and mottled sculpin (*Cottus gulosus*) (Potts and Schultz 1953). Fish stocking was occurring before the park was established in 1916 and continued until 1992. Early stocking attempts were haphazard, and many naturally barren lakes were stocked with a variety of fish. Baseline information on the current distribution and abundance of fish in

park waters does not exist. Because of the long history of fish stocking in the park, it is unclear today which lakes and streams were naturally barren, which contained native fish, and what species of fish are native to each system.

C. Earth and Water Resources

Lassen Volcanic National Park is an outstanding example of a dynamic volcanic landscape. The park is unique in that it preserves examples of all four types of volcanoes recognized by geologists: shield volcanoes, composite volcanoes, plug dome volcanoes and cinder cones. Lassen Peak is one of the largest plug dome volcanoes in the world. Also within the park is the most extensive, intact network of geothermal resources west of Yellowstone National Park.

Lassen Peak is the southernmost active volcano in the Cascade Mountain Range, which extends from northern California to British Columbia. The Cascade Range is characterized by a series of isolated volcanic peaks situated on a great lava plateau that covers much of the Pacific Northwest. Geologically, the park is a glaciated volcanic landscape. The park is unique in that it also preserves, in a relatively small geographic area, examples of all four types of volcanoes recognized by geologists: shield volcanoes, composite volcanoes, plug dome volcanoes, and cinder cones. Also within the park is the most extensive, intact network of geothermal resources west of Yellowstone National Park, including outstanding examples of boiling springs, mudpots, and fumaroles.

D. Resource Management Concerns

Non-native Species

Non-native invasive plant species have the potential to overwhelm native ecosystems of Lassen. Approximately 53 exotic plant species occur in the park or immediately adjacent to it, and less than 5 percent of the park has been surveyed for introduced plants. Based on a risk assessment and field inventories, infested sites with species of high concern consisted almost exclusively of bull thistle and common mullein along riparian areas, meadows, right-of-ways, and burned sites.

Five non-native animals are known within the park. These include three fish species (eastern brook trout, brown trout, and golden shiner), the European starling, and the brown-headed cowbird. It is likely that other non-native animal species exist. Because of the long history of stocking, it is unclear today which lakes and streams were naturally barren, which contained fish, and what species of fish are native to each system. Introduced fish species feed on aquatic vertebrates and invertebrates, and thus disrupt the natural ecological balance of streams and lakes.

Disturbed Land Restoration

Several areas of substantial land disturbance exist in the park. These include the now-closed downhill ski area near the Southwest Entrance; the Manzanita Lake developed area, where facilities were removed in the early 1970's because of rock avalanche hazard;

several borrow pits along the main park road; Drakesbad Meadow, a very unique fen that was ditched and drained prior to establishment of the park; and an earthen dam at Dream Lake. These disturbed areas are a visual blight, fragment wildlife habitat, disrupt natural water flows and provide an opportunity for the establishment of non-native plants.

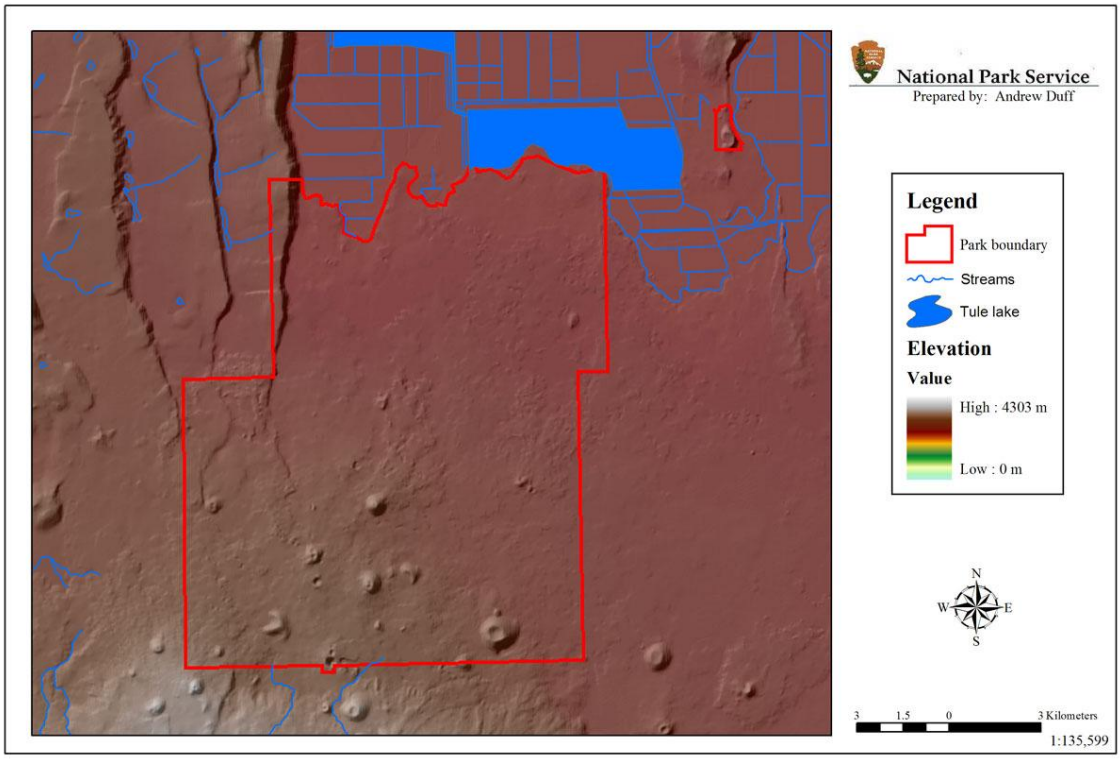
Air Pollution from Northern Sacramento Valley

Lassen Volcanic National Park is a Class I airshed. This designation requires that Federal land managers safeguard air quality from significant deterioration in order to protect air quality-related values. Air pollution in the Upper Sacramento Valley can substantially reduce vistas from within the park, reducing visibility and detracting from one of the primary visitor attractions in the park. The vitality, significance, and integrity of many park resources are dependent on good air quality. Air pollution, even at concentration levels below the National Ambient Air Quality Standards (established by the Environmental Protection Agency), can harm vegetation, degrade visual air quality, and diminish visitor enjoyment. Although ozone levels have not exceeded the federal standard to date, they have on occasion exceeded standards for the State of California.

Boundary Management and Illegal Intrusions

Cattle trespass into the park from adjoining private land. USFS cattle allotments has increased over the years and pose a significant impact to natural habitat within the park. In winter, snowmobile use, which is allowed in locations near the park boundaries, crosses into park wilderness and non-wilderness land. In non-winter months, off-highway vehicle use similarly crosses into wilderness and non-wilderness land. Water right easements have gone unmonitored and have resulted in resource damage by stream channeling and use of heavy machinery. Increased ease of access to boundaries, coupled with the presence of legal hunting adjacent to the park boundary, has resulted in periodic poaching of wildlife within the park (the actual extent of poaching is unknown, but it is thought to be an annual occurrence).

1.3. LAVA BEDS NATIONAL MONUMENT



A. General Description

Location, Size, and Elevation

Lava Beds National Monument is located in northeastern California, approximately 249 kilometers (155 miles) northeast of Redding, California, and 72 kilometers (45 miles) southeast of Klamath Falls, Oregon. Ninety-four percent of the monument's 18,898 hectares (46,700 acres) lies within Siskiyou County and the remaining six percent is in Modoc County, California. Other federal agency lands border the Monument on all sides. The Modoc National Forest and the Klamath National Forest border the east, west and south sides. The north side of the park is bordered by the Klamath Basin National Wildlife Refuges, which lease agricultural land on the adjoining boundary land, which is still used for agriculture. Lava Bed's boundaries include 11,430 hectares (28,460 acres) of designated wilderness.

The Monument ranges in elevation from 1,200 meters (4,040 feet) at the northern boundary to 1685 meters (5,529 feet) near the southern boundary.

Park Purpose and History

Lava Beds National Monument was established by presidential proclamation No. 1755 on November 21, 1925 (44 Stat. 2591). This proclamation recognized the significance of the area's cultural and natural resources: "Whereas, lands of the United States within the area

herein described…contain objects of such historic and scientific interest as to justify their reservation and protection as a National Monument…" Lava Beds National Monument is rich in both natural and cultural resources. Monument lands were home to the Modoc Indians and their ancestors for thousands of years, and were the scene of the Modoc War, which took place during 1872 and 1873. The monument contains more than 435 lava tube caves and features, and a representative variety of high elevation desert vegetation and wildlife, including threatened and endangered species.

In 1933 the administration of Lava Beds National Monument was transferred from the U.S. Forest Service to the National Park Service. On April 27, 1951 the Petroglyphs section and Mammoth Crater were added to the Monument. Two private inholdings, the Adams Estate and the Merrill Estate, were added to the monument on September 29, 1943 and May 1946, respectively.

The Civilian Conservation Corps was active in the monument from 1933 to 1942, building surface and cave trails, roads, and several Park Service structures, including the fire lookout on top of Schonchin Butte.

The monument's cultural resources consist of archeological sites from Native American occupation, historical sites from the Modoc War of 1873, and historical structures that are listed by the National Park Service as examples of Rustic Style architecture. Five of the monument's cultural resources have been entered on the *National Register of Historic Places*. Additionally, several sites and structures are on the List of Classified Structures of the NPS.

The area is rich with archaeological evidence. The geologic formations and other natural resources of the area contributed to the setting for historic events in the monument and its significance in U.S. history. During the Modoc Indian War of 1872-1873, a small band of Modoc Indians successfully held off a U.S. Army that outnumbered them by twenty times by using their detailed knowledge of natural fortifications formed by lava flows on the southern shore of Tule Lake. This was just seven years after the Civil War, and is the only Indian war on record in which the army used mortars to assault an Indian stronghold. The war culminated with the only death of a General at the hands of Indian warriors.

Climate

The high elevation semi-arid desert environment of Lava Beds receives an average of 381 mm (15 inches) of precipitation annually at park headquarters. The climate is the most continental of the parks in the network, characterized by warm to hot, dry summers, with occasional summer thunderstorms, and cold winters. Sunshine is abundant year round. The average annual high temperature is 15.6°C (60°F) and average annual low temperature is 1.7° C (35° F). Temperature extremes range from -28° C (-18° F) to 39° C (102° F). Average annual snowfall is 1118 mm (44 inches).

B. Biological Resources

Lava Beds National Monument is the site of a diverse assortment of surface geologic resources supporting a variety of semi-arid plant and associated animal communities. These communities have high biotic integrity compared to surrounding areas, which are more affected by exotic species invasions, livestock grazing and other stressors. In addition, over 400 lava tube caves and features have been identified in the monument, and the cave entrance and interior communities are associated with many unique biotic resources.

Vegetation and flora

The monument's surface character and species richness are dependent on its diversity of plant communities. Twenty-three plant communities have been identified on the monument. Three major vegetation associations have been identified for management purposes monument: 1) A Great Basin shrub-grassland community co-dominated by bluebunch wheatgrass (*Agropyron spicatum*) and basin big sagebrush (*Artemisia tridentata tridentata*)/mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*); 2) A higher elevation shrub/woodland community dominated by western juniper (*Juniperus occidentalis*) and mountain mahogany (*Cercocarpus ledifolius*); and 3) A coniferous forest community at the highest elevations and most southern extent of the monument dominated by ponderosa pine (*Pinus ponderosa*).

The lava tube collapse systems and lava outcrops support a great diversity of plant life, from an impressive variety of lichens and mosses to plants such as desert sweet (*Chamaebatiaria millefolium*) and the aromatic desert (purple) sage (*Salvia dorrii carnosa*). A variety of fern species are present in cave entrances including the spreading wood fern (*Dryopteris expansa*) and the western swordfern (*Polystichum munitum*). These species are well outside of their normal range, which is approximately 145-200 km (90-125 miles) away on the northern California coastline.

Despite the presence of unusual habitats and disjunct species, there are no plant species of special concern due to rarity known from the Monument.

Fauna

About half of the California population of Bald Eagles (*Halioeetus leucocephalus*), which are federally listed, use the Klamath Basin as a wintering area. The monument supports a small part of this population. Other raptors are also common in the monument, including Prairie Falcons (*Falco mexicanus*) and Short-eared Owls (*Asio flammeus*). The petroglyphs section of the monument is extremely rich in bird life, and is a popular birding location. The threatened Peregrine Falcon (*Falco peregrinus*) nests in the steep walls of the petroglyphs section. Other common species of birds found in the monument include: Cooper's Hawk (*Accipiter cooperii*), American Kestrel (*Falco sparverius*), Blue Grouse (*Dendragapus obscurus*), California Quail (*Callipepla californica*), Mountain

Quail (*Oreortyx picus*), Common Barn Owl (*Tyto alba*), Northern Pygmy Owl *(Glaucidium gnoma*), Short-eared Owl (*Asio flammeus*), Common Night Hawk (*Chordeiles minor*), Anna's Hummingbird (*Calypte anna*), Black-chinned Hummingbird (*Archilochus alexandri*), Common Flicker (*Colaptes auratus*), Violet-green Swallow (*Tachycineta thalassina*), Scrub Jay (*Aphelocoma coerulescens*), Common Bushtit (*Psaltriparus minimus*), Canyon Wren (*Salpinctes obsoletus*), American Robin (*Turdus migratorius*), Townsend's Solitaire (*Mydestes townsedi*), Brewer's Blackbird (*Euphagus cyanocephalus*), House Finch (*Carpodacus mexicanus*), Spotted Towhee (*Pipilo erythrophthalmus*), and Dark-eyed Junco (*Junco hyemalis*).

Fourteen species of bats have been recorded in the monument, including the largest, northern-most population of the Brazilian free-tailed bat (*Tadarida brasiliensis mexicana*). The Townsend's big-eared bat (*Corynorhinus townsendii townsendii*), a state and federally listed species of special concern, resides in the monument, one of the last strongholds for this species. The largest known hibernaculum of this species on the West Coast is located in the monument. Other species of bats include: little brown myotis (*Myotis lucifugus*), Yuma myotis (*Myotis yumanensis*), long-eared myotis (*Myotis evotis*), fringed myotis (*Myotis thysanoides*), California myotis (*Myotis californicus*), small footed myotis (*Myotis ciliolabrum*), long-legged myotis (*Myotis volans*), silver-haired bat (*Lasionycteris noctivigans*), big brown bat (*Eptesicus fuscus*), hoary bat (*Lasiurus cinereus*), western pipistrelle (*Pipistrellus hesperus*), and pallid bat (*Antrozous pallidus*).

Other common mammals found in the park include: coyote (*Canis latrans*), bobcat (*Lynx rufus*), mountain lion (*Felis concolor*), and mule deer (*Odocoileus hemionus*). Bushy-tailed woodrat (*Neotoma cinerea*) and dusky footed woodrat (*Neotoma fuscipes*) are generally found in and around caves, and kangaroo rat (*Dipodomys californicus*) and western harvest mouse (*Reithrodontomys meglotis*) are common throughout the monument. The yellow bellied marmot (*Marmota flaviventris*) is found mainly along the historic lake shore of Tule Lake, while pika (*Ochotona princeps*) are found exclusively in lava tube collapses and lava outcrops. Mountain cottontail (*Sylvilagus nuttallii*) and black-tailed jack rabbit (*Lepus californicus*) are common in the monument as are California ground squirrel (*Spermophilus beecheyi*) and golden mantled ground squirrel (*Spermophilus lateralis*). Belding's ground squirrel *(Spermophilus belding*) is found at the lower elevations in the monument and the petroglyphs section.

Because of a lack of surface water in the monument amphibian presence is limited and no fish are present. The most common amphibian species found in the monument is the pacific tree frog (*Hyla regilla*). This species is also a resident of Fern Cave, a biologically rich and culturally significant cave in the monument. Reptile species found in the monument include: northern sagebrush lizard (*Sceloporus graciosus graciosus*), Great Basin fence lizard (*Sceloporus occidentalis biseriatus*), western skink (*Eumeces skiltonianus skiltonianus*), Rocky Mountain rubber boa (*Charina bottae utahensis*), gopher snake (*Pituophis melanoleucus*), desert night snake (*Hypsiglena torquata deserticola*), and western rattlesnake (*Crotalis virdis*).

Federal and state animal species of special concern in the Monument include: Bald Eagles (*Halioeetus leucocephalus*), Cooper's Hawk (*Accipiter cooperii*), fringed myotis (*Myotis thysanodes*), long-eared myotis (*Myotis evotic*), long-legged myotis (*Myotis volans*), pallid bat (*Antrozous pallidus*), silver-haired bat (*Lasionycteris noctivigans*), Townsend's big-eared bat (*Corynorhinus townsendii*), western small-footed myotis (*Myotis ciliolabrum*), and American badger (*Taxidea taxus*). Additional species of concern are listed in Appendix E.

C. Earth and Water Resources

Because of its extensive geologic history Lava Beds National Monument is the site of a diverse assortment of surface geologic resources including a variety of cinder cones, spatter cones, and lava tubes. In addition to these surface geologic resources, the monument has a significant and popular underground resource: over 400 lava tube caves and features have been identified in the monument. (The field inventory of cave resources is not yet complete.) These caves are notable in their abundance, length of passage, and excellent preservation of primary volcanic features; several also contain specific features of interest such as pictographs, ice formations, and biological resources of scientific interest.

Lava Beds National Monument is the site of the largest concentration of lava tube caves in the United States. The monument lies on the northeast flank of the Medicine Lake shield volcano, the largest volcano in the Cascade Range. The region in and around the monument is unique because is lies on the junction of the Sierra-Klamath, Cascade, and Great Basin geological provinces. In addition, the monument is geologically outstanding because of its great variety of "textbook" volcanic formations; i.e., lava tube caves, fumaroles, cinder cones, spatter cones, maar volcanoes, and lava flows. Over 30 separate lava flows located in the park range in age from 2,000,000 years B.C. to 1,110 years B.C.. Some of the major lava flows within Lava Beds National Monument include: Callahan Flow, Schonchin Flow, Mammoth Crater Flow, Modoc Crater Flow, and Devils Homestead Flow.

There are no terrestrial water resources in Lava Beds National Monument.

D. Resource Management Concerns

Recreational Use

The majority of human visits at Lava Beds National Monument are concentrated in the small fraction of caves that are open and accessible to the general public. These caves bear the brunt of the impact of thousands of visitors each year.

Land Use Impacts

A geothermal plant is in the final approval stages for construction at Four Mile Hill on the Medicine Lake volcano. Transmission lines and emissions from the generating plant

threaten the view shed, the forest ecosystems and the sacred sites of local Native American tribes to the south of the monument in the Medicine Lake Highlands.

Lava Beds is located in a Class I airshed. The air quality of the local area is threatened by wood burning stoves in the local basin, seasonal prescribed and natural fire occurrence, and other impacts. Monitoring of air quality indicators is done throughout the year through cooperative agreements with the California Environmental Protection Agency Air Quality Board, and an IMPROVE station was installed by the University of California, Davis Crocker Nuclear Lab Air Quality Group in 2000. Ozone levels are measured during the summer months by the National Park Service.

The monument has initiated a dark night sky program to preserve the views of the spectacular nighttime skies over the monument. A monitoring program and lighting protocols have been established to guide future management actions in the monument. The night skies would be also negatively impacted by the construction of the Four Mile Hill geothermal plant and transmission lines.

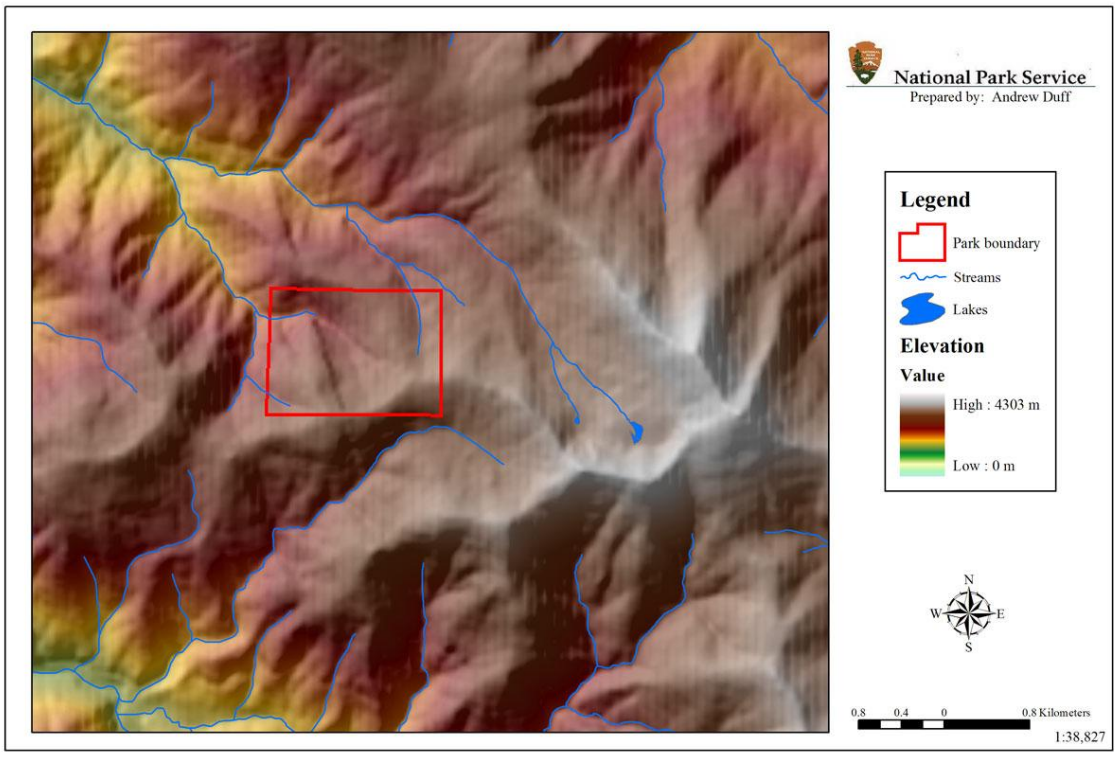
Non-native Species

Lava Beds has a variety of exotic plants to contend with and is taking aggressive measures to inventory and eradicate these species. Several species are managed currently including: common mullein (*Verbascum thapsus*), horehound mint (*Marrubium vulgare*), stinging nettle (*Urtica gracilis*), bull thistle (*Cirsium vulgare*), and yellow sweetclover (*Melilotus officinalis*). Other species such as cheatgrass *(Bromus tectorum*) and tumble mustard (*Sisymbrium altissimum*) are common and at this time uncontrollable in certain areas of the Monument.

Fire Suppression

Fire has played a significant historic role in shaping and maintaining the ecosystems of Lava Beds National Monument. However, a total fire exclusion policy from 1925 through 1976, grazing by a variety of domestic animals and a western pine beetle infestation in the 1920's have combined to drastically alter the distribution and abundance of fuels, vegetation, and wildlife. The historic fire occurrence was relatively frequent in many areas of the Monument, and the fires were often very large and of short duration.

1.4. OREGON CAVES NATIONAL MONUMENT



A. General Description

Location, Size, and Elevation

Oregon Caves National Monument lies near the top of a steep drainage in the Siskiyou Mountains of southwest Oregon just north of the California border. The main part of the Monument is 196 hectares (484 acreas), and is located 32 km (20 miles) east of Cave Junction via Oregon Highway 46. The 1.6 hectare (4 acre) visitor center site is located in the town of Cave Junction. Elevation in the monument ranges from 1,122 to 1,670 meters (3,680 to 5,480 ft.) for the main part of the Monument and 549 meters (1,800 feet) for the visitor center.

Oregon Caves National Monument is small in size, but rich in diversity. Above ground, the monument encompasses a remnant old-growth coniferous forest. It harbors a fantastic array of plants, and a Douglas-fir tree with the widest known girth in Oregon. Below ground is an active marble cave created by natural forces over hundreds of thousands of years in one of the world's most diverse geologic realms. (Although there are eight other known caves in the Monument, they are much smaller and have few formations, hence, when this report describes "the cave," it is referring to the largest one.

Park Purpose and History

Oregon Caves National Monument was created by Presidential proclamation in 1909 to protect a three mile cave "of unusual scientific interest and importance." The proclamation

states that "…the public interests will be promoted by reserving these caves with as much land as necessary for the proper protection thereof." The monument was transferred to the National Park Service in 1933. From 1933 to 1942, the Civilian Conservation Corp landscaped a 2.8 hectare (7 acre) National Historic District and put in roads, trails, buildings, and the public water supply. A 1999 general management plan recommended protecting the Monument's edges, scenic vistas, caves, and public water supply by adding 1381 ha (3,410) acres of adjacent late-successional USFS lands (these lands have not been incorporated in the monument to date).

Climate

The Monument is located in the heavily wooded Siskiyou Mountains of southwest Oregon. The climate of the region is strongly influenced by the ocean, which contributes to relatively mild summers and winters. Temperatures typically range from -6.6° C (20° F) to 4.4° C (40° F) during the winter and from 10° C (50° F) to 32° C (90° F) during the summer. The cave temperature is 5.6 °C (42° F) year round. Approximately 1397 mm (55 inches) of precipitation falls per year, mostly as wet snow. Moderate winds are common, especially prevailing winds from the west, storm winds from the south, and diurnal winds blowing up canyon (from the northwest) during the day and down canyon (from the southeast) in the evening.

B. Unique Features

The Monument is of national significance for its mammalian fossils. A radiocarbon date of more than 50,000 years was determined from what appears to be a grizzly bone that was found in the cave. This is far older than the oldest of other Western Hemisphere records of grizzly bones. A jaguar skeleton may be the most complete ever found and dates from 20,000 to 40,000 years old. Scratches, possibly from black bears, have been found on sediment and appear to be very old as well. Other rare fossils found on Oregon Caves include the mountain beaver and blue grouse. Outside the caves are plant and animal communities of generally high biotic integrity and diversity.

Vegetation and flora

Oregon Caves National Monument is home to 391 vascular plant species (including thirteen regional endemics and 49 non-natives), 93 bryophyte species, 120 lichen species, and 250 to 400 kinds of macrofungi. The main controls on plants at Oregon Caves are temperature and moisture. These in turn are affected by precipitation, elevation, slope steepness, fire, humans, slope orientation, and soil types.

In part because it occurs at low elevations, the Douglas-fir/Oak community (covering 19 percent of Monument) is among the driest. It represents the upper bounds of the Mixed Evergreen zone in southwest Oregon. Dry White Fir/Douglas-fir (20 percent) occurs at middle elevations and on gentle, other than north-facing slopes. The mesic White Fir/Douglas-fir community (26 percent) occurs at high elevations and on other than south-facing slopes. The White Fir/Herb community (20 percent) occurs at high

elevations on north facing, often steep slopes. This is the highest zone in the Monument, is transitional to the Red Fir zone, and contains the oldest trees in the Monument, including the Big Tree, the largest diameter Douglas-fir known in Oregon. The Oak community (6 percent of Monument) is found mostly in areas of chert mounds. Meadows (8 percent) occur where there are relatively infertile, shallow soils from granite, meta-basalts and serpentine and where wind piles up snowbanks and dust on the lee side of ridges. The Alder community (1 percent) occurs along upper elevation streams scoured during a 1964 flood that damaged the historic lodge. Natural fire cycles run about 30 years in the lower elevations of the Monument and about 70 years in the upper.

No plants with special status are known to live in the Monument.

Fauna

Oregon Caves National Monument is home to approximately 50 mammal species, 86 bird species, 11 reptile and amphibian species, 8 bat species, more than 200 arthropod species, 8 snail/slug species, 75 butterfly species, more than 55 moth species, and 8 different aquatic macro-invertebrates. This includes 160 species within the cave itself.

Recent species lists indicate there are about a dozen endemic macro-invertebrates in the main cave out of a total of about 110 known arthropods. The endemics include flies, beetles, millipedes, grylloblatids, springtails, and water mites. Based on identifications by Dr. Steve Crawford (1994), from the Burke Museum in Seattle, Oregon Caves has at least nine invertebrate species that so far are only known from the caves. There are also at least 30 different microbes that live in the cave as well as tissue moths, harvestmen (daddy longlegs), wood rats (*Neotoma fuscipes*), snails, slugs and spiders.

There is plenty of visible wildlife outside the cave as well. Some of the commonly seen animals are black-tailed deer (*Odocoileus hemionus*), Stellar's Jay (*Cyanocitta stelleri*), Common Raven (*Corvus corax*), Douglas' squirrel (*Tamiasciurus douglasii*), and the Townsend's chipmunk (*Eutamias townsendii*). Less frequently seen residents include black bear, mountain lion, flying squirrel (*Glaucomys sabrinus*), Pacific giant salamander (*Dicamptodon tenebrosus*), mountain beaver (*Aplodontia rufa*), trout, and the Northern Spotted Owl.

A high diversity of fish, aquatic invertebrates, and salamanders occurs with physical complexity where coarse woody debris and gravel creates both riffles and deep pools. The mix of old-growth and moderate disturbance produces much woody debris, and in general, the more wood, the higher is the biodiversity of stream invertebrates. Abundant gravel and detritus combined with low temperatures in the Monument’s streams enhances diversity.

Few areas have so many different rocks side by side. Springs emerge at these interfaces and are host to flatworms, frogs, protists, newts, aquatic beetles, snails and bugs. Both isolated marble and aquatic habitats favor snail evolution. Likewise, moist caves or

riparian old-growth harbor certain coastal crickets, rodents, and grylloblatids that typically occur further north, on glaciers.

North facing slopes, high elevation, subsurface streams, and springs on the Monument allow for fairly wide, permanent streams, which harbor tailed frogs (*Ascaphus truei*) and Pacific giant salamanders. Riparian reptile, amphibian, and fish diversity in the Monument, however, is low overall since these species decrease with increasing elevation and stream gradients.

The Monument is also home to a range of animal species with special status (Appendix E), including the federally listed Northern Spotted Owl and several species of concern: mountain kingsnake (*Lampropeltis zonata*), tailed frog, Del Norte salamander (*Plethodon elongates*), Northern Goshawk (*Accipiter gentiles*), Olive-sided Flycatcher (*Contopus cooperi*), Little Willow Flycatcher (*Empidonax traillii brewsteri*), Siskiyou gazelle beetle (*Nebria gebleri siskiyouensis*), and Pacific fisher (*Martes pennanti*). Five species of concern occur in the cave: Townsend's big-eared bat (*Corynorhinus townsendii*), long-eared myotis (*Myotis evotis*), fringed myotis (*Myotis thysanodes*), long-legged myotis (*Myotis volans*), and Yuma myotis (*Myotis yumanensis*).

C. Earth and Water Resources

Beneath the Monument's surface lies one of the largest exposures of ultramafic rock in North America and one of the largest, most pristine, and most complete segments of old oceanic crust in Western America. The Monument contains one of the most biologically and geologically diverse caves in the world. The caverns also harbor one of the largest assemblages of endemic cave dwelling insects in the United States, and, recently, it has gained notoriety for the Pleistocene aged jaguar and grizzly bear fossils found in some of the deeper chambers. Cave features rarely reported elsewhere include Mundmilch and flowstone-covered vermiculations, flexible, velvet and subaqueous flowstone, mud stalactites, root-core cave "ghosts", high crystal pool densities, chert patina, quartz dikes and sub-minimum stalactites.

The importance of the land above the cave cannot be overlooked. Many of the processes occurring within the cave are greatly influenced by what is happening above ground, especially where there is an exchange of air, water, and food between the connected ecosystems. The Monument preserves a pristine watershed in the headwater tributaries of the Illinois River. This is one of the last major undammed rivers in the Pacific Northwest, and is open to spawning salmon and steelhead. In addition, five small springs begin and flow most years in the Monument. One spring becomes Upper Cave Creek, which sinks into its bed and emerges as Cave Creek from the cave's main entrance. The underground water system in the cave has created more than 4572 meters (15,000 ft.) of known cave and continues to create still more today. Surface streams that largely dry up after spring snowmelt recharge the present cave stream. Water enters the cave from Upper Cave Creek and from the soils above. Much of this is from snowmelt, and thus the water level changes throughout the year, with higher flows during the spring runoff and lower flows

in late summer. However, despite summer-long droughts, stream runs through the cave all year.

Cave water has been tested for major ions, pH, temperatures, flow rates, the most important biological nutrients (phosphate, phosphorus), and the presence of long chain hydrocarbons. To date, there is no indication of significant human-caused pollution.

The main cave at the monument formed mostly underwater, as a braided passage network. Fluctuations in groundwater levels and flow behavior have left their mark on the cave where passages show subsurface stream piracy, vertical shafts, bevels from flooding, and smooth ceilings from atmospheric corrosion. Cave formations in the main cave include speleothems that result from deposition, bedrock and fill features, and speleogens that result from solution. The wall rock is composed of late Triassic to mid-Permian metamorphosed sedimentary rock (mostly marble, with some argillite and metachert). Regionally, metamorphism is low grade (mid-level in greenschist facies). Higher grade metamorphosed sedimentary rocks (evidenced by the presence of garnet, biotite and actinolite) can be seen in the cave near quartz diorite plutons and dikes. A structural alignment between major faults and bedding strike, and a steep hydraulic gradient, enabled ground-water dissolution of the bedrock into one of the few large marble caves in the Pacific Northwest. Cave features that are either rare or not reported elsewhere include Mundmilch and flowstone-covered vermiculations; flexible, velvet, and sub-aqueous flowstone; mud stalactites; high crystal pool densities; chert patina; dikes; and sub-minimum stalactites. The shape and color of many features changes with depth and proximity to entrances.

D. Resource Management Concerns

Cave Environment

Airlocks, and rubble, algae and lint removal to restore the cave started in 1985. Global CO2 increases are likely affecting cave biota and the solutional balance of cave limestone. There is a $>4^0$ F. surface warming in last 20 yrs., large rooms in caves are also warming.

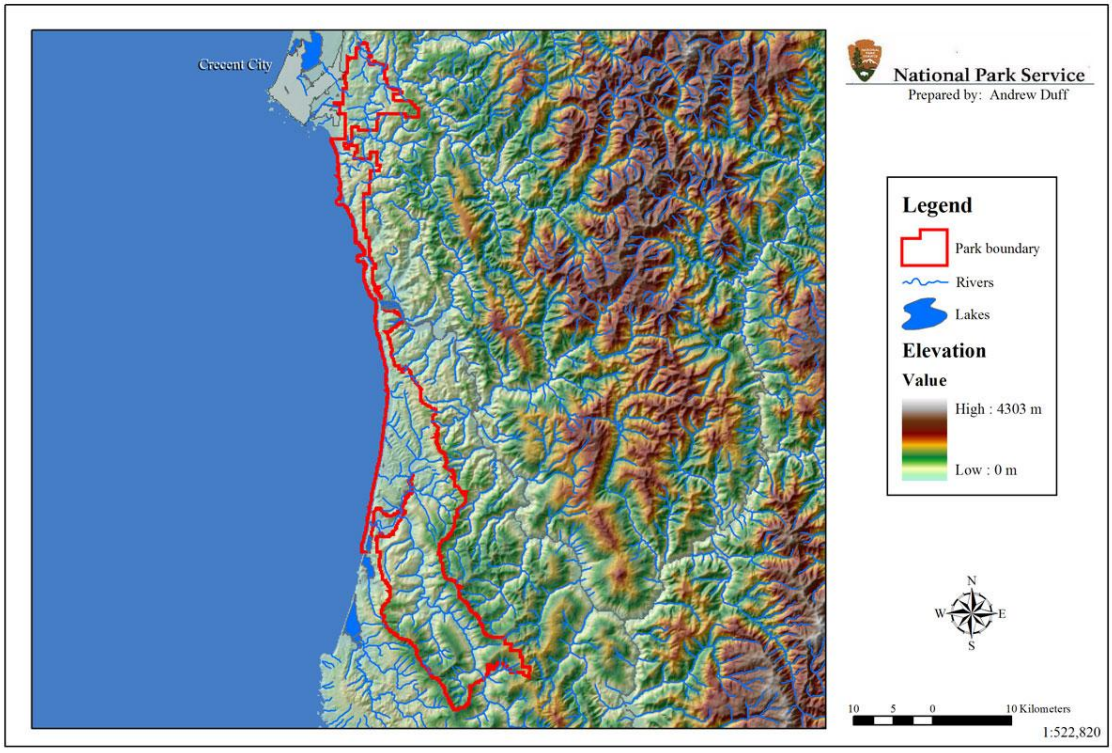
Human Impacts

Suppression of fire may be the biggest source of human impact on the Monument. Fire suppression has increased the bark beetle, mistletoe, white-fir, and shrub density and decreased the abundance of Douglas-fir, meadows, and ten sun loving herbs. More than half of the land adjacent to the Monument has been logged. Edge effects include changes in microclimate, up to 150 meters into old growth, increased indicence of non-natives, and decreased trilliums, orchids, herptofauna, voles, bats, epiphytes, and view sheds. A high road density affects arthropods and larger animals. Regional human impacts on precipitation from changes in albedo due to fire suppression and timber harvests likely have occurred.

Non-Native Species

Non-native species of flora in the monument have declined, as 120,000 plants have been pulled in the last thirteen years. *Phytophthora* root rot, which may be transported by clinging to the underside of vehicles, has invaded nearby areas and could kill many of the Port-Orford Cedar trees in the Monument. Other introductions with potentially serious repercussions could include gypsy moths, dogwood anthracnose, and Sudden Oak Death.

1.5. REDWOOD NATIONAL AND STATE PARKS



A. General Description

Location, Size, and Elevation

The Redwood National and State Parks (RNSP) are headquartered in Crescent City, California, which is equidistant (563 kilometers; 350 miles) from San Francisco, CA, and Portland, OR. The parks consist of four administrative units in Del Norte and Humboldt Counties: Redwood National Park, which is a federal park under the jurisdiction of the Park Service (NPS), and three state parks, under the jurisdiction of the California Department of Parks and Recreation (CDPR). The legislated national park boundary includes the three state parks (Prairie Creek Redwoods State Park, Del Norte Coast Redwoods State Park, and Jedediah Smith Redwoods State Park). Together, these four parks encompass about 42,700 ha (105,516 acres), are about 80 km (50 miles) in length with 56 km (35 miles) of coastline, and vary in width from 0.8 to 13 km (0.5 to 8 miles).

The north-south U.S. Highway 101 is the main road through the parks, winding its way through forested hills and along the rugged coastline. Three miles northeast of Crescent City, U.S. Highway 199 joins U.S. Highway 101 and provides an east west route through Jedediah Smith Redwoods State Park. On its western side, the national park boundary extends 400 m (0.25 miles) beyond the Pacific Ocean's mean high tide line, and the National Park Service exercises jurisdiction over the waters, intertidal lands, and submerged lands. The coastal jurisdiction of state parklands extends 305 m (1,000 feet) west of the ordinary high-water mark. Elevations within the park range from sea level to 996 m (3,267 feet) at an un-named peak in the Coyote Creek drainage.

Park Purpose and History

Redwood National Park was established in 1968 and expanded in 1978. Prairie Creek Redwoods State Park was established in 1923, Del Norte Coast Redwoods State Park in 1925, and Jedediah Smith Redwoods State Park in 1929. These parks were established to preserve significant examples of the primeval coastal redwood forests and the prairies, streams, seashore, and woodlands with which they're associated for purposes of public inspiration, enjoyment, and scientific study, and to preserve all related scenic, historical, and recreational values.

Climate

The climate of near-coastal northwestern California and southwestern Oregon is temperate, with rainy winters, dry summers, and frequent coastal fog and stratus. Mean annual precipitation at Crescent City is 1778mm (70 inches); at Klamath, 2210 mm (87 inches); and at Orick, 1753 mm (69 inches). Winter storms are usually intense with heavy rainfall and high winds interspersed with intervals of generally fair weather. Annual rainfall often exceeds 2540 mm (100 inches) per year in interior portions of the park. Seasonal temperatures are moderated by the influence of the Pacific Ocean, becoming more extreme inland. Snow is uncommon; it occurs at higher elevations within the park two or three times a year and usually melts rapidly. At Crescent City, the mean annual temperature is 11.4° C (52.6° F) and the mean daily maximum and minimum temperatures are 15.8° C (60.4° F) and 7.1° C (44.8° F), respectively, with a recorded high of 33.3° C (92° F) and low of -4.4° C (24° F). At Orick (Prairie Creek), the daily mean maximum temperature is 16.2° C (61.1° F) and the minimum is 6.0° C (42.8° F).

It is estimated that coastal fogs bathe the redwood coast on 90 to 120 days each year, most often in the summer. These fogs strongly moderate the influence of the summer drought by directly contributing moisture as fog drip and by reducing evapo-transpiration. Since this fog occurs at low elevations (< 1000m), areas along the coast or in coastal valleys often show markedly more mesic vegetation than areas just upslope or a few km inland.

B. Biological Resources

Redwood contains a wide variety of plant and animal communities, ranging from kelp forest, intertidal, and estuarine marine communities, to emergent wetlands, to terrestrial communities on the immediate coast as well as more inland areas. Forests include some among the tallest in the world. There are also extensive forests recovering from clear cut logging.

Vegetation and flora

The region encompassing the present parklands is primarily forested with small areas of prairie and coastal scrub. Sitka spruce (*Picea sitchensis)* dominates the forests immediately adjacent to the ocean. Inland from the spruce forests, coast redwood (*Sequoia sempervirens)* dominates, with Douglas-fir (*Pseudotsuga menziesii*), tanoak

(*Lithocarpus densiflorus)*, western hemlock (*Tsuga heterophylla*), and grand fir (*Abies grandis*) occurring as common associates. With increasing elevation and distance from the ocean, redwood becomes less abundant. Beyond 16 and 24 km (10 to 15 miles) inland, redwood is rare and Douglas-fir dominates forests, except where serpentine soils provide habitat for specialized vegetation.

Sixteen terrestrial vegetation types have been described for the park. These include old growth redwood forest, second-growth redwood forest, select harvested redwood forest, encroaching Douglas-fir forest, alder forest, prairie, oak woodland, mixed evergreen forest, riparian, coastal shrub, coastal spruce forest, freshwater marsh, coastal strand, Jeffrey pine woodland, chaparral, and unvegetated bare ground. While extensive alteration of both the forests and non-forest vegetation has occurred, their distribution is essentially the same now as when it was described in the first written records. Since 1850 more than 20,235 ha (50,000 acres) of redwood vegetation now within the park have been clear-cut or selectively harvested. Most of the timber harvesting has occurred since 1950. Additional forest land has been less modified. Limited tree cutting in some areas left a largely intact canopy. Prospecting, pasturage, burning of understory, and other disturbances also resulted in forest changes.

Much of the Sitka spruce forest was logged prior to 1940 for making boxes and airplane structural members. In the Gold Bluff area, other spruce stands were cut or burned during the gold mining era. All parklands subjected to timber harvest are in some phase of forest regeneration. Douglas-fir dominates most of the second growth although some native redwood and alder trees have re-established in wetter, cooler areas. Coastal and moist sites support alder and spruce, and the fast-growing but short-lived alder are eventually replaced by spruce. Mesic sites away from the immediate coast support second-growth stands of varying age classes where redwood and Douglas-fir dominate, and hemlock and spruce are well represented. Douglas-fir is over-represented in the youthful second growth stands. An evaluation of second-growth redwood vegetation is underway to define the probable long-term stand development.

Grasslands within the park have been greatly modified through agricultural use, including grazing, and now are largely composed of exotic grasses and Eurasian weeds. They are similar in appearance to the native grasslands but differ in composition. Plant succession in the prairies may lead to development of shrub lands or forest. Severe occurrences of Douglas-fir encroachment into inland grasslands and adjacent Oregon white oak woodlands, since 1850, have been observed in the park and are usually related to disturbance by domestic livestock, road building, and lack of fire.

Coastal strand, coastal bluffs, rock outcrops, streamsides, wet meadows, bogs and serpentine soils host the majority of the rare plants in RNSP. There is one federally listed plant, beach layia (*Layia carnosa*), that is found growing on the dunes in the southern end of the parks. The rest of the rare or sensitive plants in RNSP have been recognized by the California Native Plant Society as shown in Appendix E. Common dune plants are yellow sand verbena (*Abronia latifolia*), dunegrass (*Leymus mollis*), and beach morning glory (*Calystegia soldanella*).

Lush growths of algae flourish in Redwood's subtidal zone. Most notable are kelp forests are composed of dense stands of large brown algae, giant kelp (predominately bull kelp (*Nereocystis leutkeana*) or bladder kelp (*Macrocystis pyrifera*), with an understory of various red and brown algae. Kelp forests are especially productive ecosystems. The giant kelp is one of the fastest growing plants known.

Rocky intertidal habitat at Redwood National Park.

Fauna

The park contains a broad spectrum of the fish and wildlife species of the pacific states. Marine mammals, anadromous fish, and many species of birds are migratory; the remaining species are residents in the park and adjacent lands.

Some faunal species have been reduced in number since 1850. The grizzly bear (*Ursus arctos horribilis*) and California condor (*Gymnogyps californianus*) were extirpated and no longer inhabit the park. The Roosevelt elk (*Cervus elaphus rooseveltii*) were hunted nearly to extinction by the end of the 19th century, but remnants persisted. With protection and the removal of cattle from grasslands, elk have extended their range into areas formerly used. Large herds are now found on national and State Park lands in the Redwood Creek basin. Species dependent upon old-growth forest habitat have declined and may be threatened with extinction in the region. These include the Northern Spotted Owl (*Strix occidentalis caurina*) and Marbled Murrelet (*Brachyramphus marmoratus*), Del Norte salamander (*Plethodon elongatus*), Olympic salamander (*Rhyacotriton olympicus*), tailed frog (*Ascaphus truei),* and Pacific fisher (*Martes pennanti pacifica*). Potential threats to these species include displacement/competition by exotic species, excess sedimentation in watercourses, high water temperatures, contaminants, predation, loss of habitat, hybridization, and other factors.

Roughly 27,519 ha (68,000 acres) of the National and State Park's vegetation has been disturbed by past logging, grazing, and farming, and is now in various stages of succession. The wildlife habitat provided by these disturbed vegetation types is also undergoing rapid modification as the forests regrow. The quality of the habitat, for many mammals, is variable depending on the age of the forest. The nature and extent of the effect of vegetative succession on all wildlife species inhabiting the park is largely unknown.

The rocky Redwood coast provides habitat for a rich marine fauna. Species commonly observed in the splash zone on the northern California coast include rock lice (*Ligia oceanica*), acorn barnacles (*Chthamalus dalli* and *Balanus glandula*) and the limpet (*Collisella digitalis*). The checkered periwinkle (*Littorina scutulata*) and the gray

periwinkle (*Littorina keenae*) can be found in the lower levels of the splash zone where they move about on the rocky faces.

In the intertidal or littoral zones, limpets and barnacles are adapted to withstand fierce wave action. Purple sea urchin (*Strongylocentrotus purpuratus*) can be found in very wave-ridden places where they use their tough spines to scrape rock cavities. Additionally, California mussels (*Mytilus californianus*), common starfish (*Asterias forbesii*), and leaf barnacles (*Pollicipes polymerus*) or gooseneck barnacles (*Lepas anatifera*) inhabit these littoral zones.

Kelp forests are home to diverse invertebrate assemblages, including anemones, abalones, sea stars, urchins, and sea cucumbers and fish such as the blacksmith (*Chromis punctipinnis*), kelp bass (*Paralabrax clathratus*), and several species of rockfish (*Sebastes* spp.) and surfperch (*Hyperprosopon* spp.). Harbor seals (*Phoca vitulina*) forage the kelp beds for fish.

Freshwater and estuarine aquatic systems in the park have been greatly modified by habitat alteration and overharvesting of fish. Sediment eroded from timber-harvested slopes and roads has degraded stream habitat for anadromous fish and aquatic invertebrates. A flood control project has degraded estuarine fish-rearing habitat. In particular, the salmon and steelhead stocks are rapidly declining in park streams. Drought, overharvesting in the ocean, loss in genetic diversity and habitat degradation may be causing these declines. The park's summer steelhead stock is considered by the American Fisheries Society to be a stock at risk of extinction. Beyond the local extirpation of the sea otter (*Enhydra lutris*), the decline in stellar sea lions (*Eumetopias jubatus*), and the reduction of salmonids, little change has occurred.

Anadramous fish including chinook salmon (*Onchyrhynchus tshawytscha*), coho salmon (*Onchyrhynchus kisutch*), and summer steelhead trout (*Onchyrhynchus mykiss gairdneri*) are known to occur in the parks streams and rivers.

Two threatened species, the Northern Spotted Owl (*Strix occidentalis caurina*) and Marbled Murrelet (*Brachyramphus marmoratus*), are known to reside in the park forests. These species are largely dependent on old-growth forests; however, the owl can occur in older (over 40 years old) second-growth forests. Snowy Plovers (*Charadrius alexandrinus nivosus*), a threatened species may occur on beaches in the park. Bald Eagles (*Haliaeetus leucocephalus*) and the recently de-listed Peregrine Falcon (*Falco peregrinus*) are known to nest in the park. Endangered leatherback turtle (*Dermochelys coriacea*), and threatened Brown Pelican (*Pelecanus occidentalis californicus*), green turtle (*Chelonia mydas*), Olive Ridley sea turtle (*Lepidochelys olivacea*), loggerhead turtle (*Caretta caretta*), stellar sea lion (*Eumatopias jubatus*), and the recently de-listed Aleutian Canada Goose (*Branta canadensis leucopareia*) are seasonal transients. Endangered tidewater goby (*Eucyclogobius newberryi*) may still be residing in the Redwood Creek estuary and other estuarine systems within the parks coastal boundaries.

C. Earth and Water Resources

Three major river systems and numerous coastal streams traverse the parks. These include portions of Redwood Creek, the Smith River, and Klamath River. The Smith and Klamath Rivers are part of the federal and state wild and scenic river systems.

Redwood National and State Parks have two distinctive physiographic environments: the coastline and the mountains of the Coast Range. The coastline is, for the most part, unaltered by post-settlement occupation. It is rugged, with stretches of steep, rocky cliffs broken by rolling slopes that are covered by grass and brush. The tidal zone is generally rocky and difficult to traverse, except for Gold Bluffs Beach, a seven-mile expanse of dunes and sandy beach.

The dominating physiography of the Coast Range lies inland from the coast. Major streams and ridgelines trend northwest. The gently rounded summits of the mountains contrast with the steep sideslopes that have been deeply incised by streams.

The bedrock beneath RNSP is primarily of the Franciscan assemblage, a collection of sandstone, siltstones, and minor amounts of conglomerates. The soils in RNSP are primarily derived from the Franciscan assemblage. Variations in soil types are controlled primarily by the topography and varying rock types in the underlying Franciscan assemblage. Local variations may result from microclimatic differences influenced by slope aspect.

D. Resource Management Concerns

Erosion

Erosion and sedimentation that threaten the aquatic and riparian resources of certain streams within the parks, primarily Redwood Creek and its tributaries, are of major concern to the parks. Recent major storms and the resulting severe erosion and damage to the parks' resources have underscored the need to accelerate significantly the current rate of watershed restoration efforts within and upstream of the parks. Within the park, there are 363 km (225 miles) of former logging roads of which 242 km (150 miles) are targeted for removal. The remaining 113 km (70 miles) of road are pending evaluation of administrative needs for these roads weighted against their erosion potential and long-term maintenance. Upstream of the park approximately 1790 km (1,110 miles) of logging roads remain; the majority of which were constructed prior to the 1983 state Forest Practice Rules amendments. Of these roads, half are currently not maintained. Of the total estimated erosion potential from all roads within the Redwood Creek basin (5,185,000 cubic meters of sediment), 85 percent is associated with roads upstream of the national park on private timber lands. These poorly constructed and maintained roads represent a major threat to resources along the main stem of Redwood Creek in the national park.

Watersheds

The Redwood Creek federal flood control project levees, which extend for 5.5 km (3.4 miles) from just upstream from the town of Orick westward to about 30 m (1,000 feet) from the Pacific Ocean, have altered the physical and biological functioning of the Redwood Creek estuary. This has resulted in major adverse impacts such as decreased water circulation in the estuary and sloughs, fewer deepwater pools, decreased extent of wetlands and riparian habitat, deteriorated water quality, degraded juvenile rearing and adult holding habitat for fish, and reduced wildlife and invertebrate abundance and diversity in the lower Redwood creek valley and estuary. The natural functioning of the Redwood Creek estuary is critical to the survival of anadromous fish such as salmon and steelhead.

Non-Native Species

The extent of competition between non-native and native species is unknown. Baseline data on abundance and distribution of non-native bird species like Brown-headed Cowbird, Starling, and Barred Owl is needed. During on the park's program for monitoring Northern Spotted Owl nests and activity centers over the past several years, the displacement of federally listed spotted owls from their established territories by Barred Owls was noted. The status of displaced spotted owls, frequency of occurrence, social/behavioral changes to spotted owls, breeding success of both species, and other biological parameters is lacking.

Marine Environment

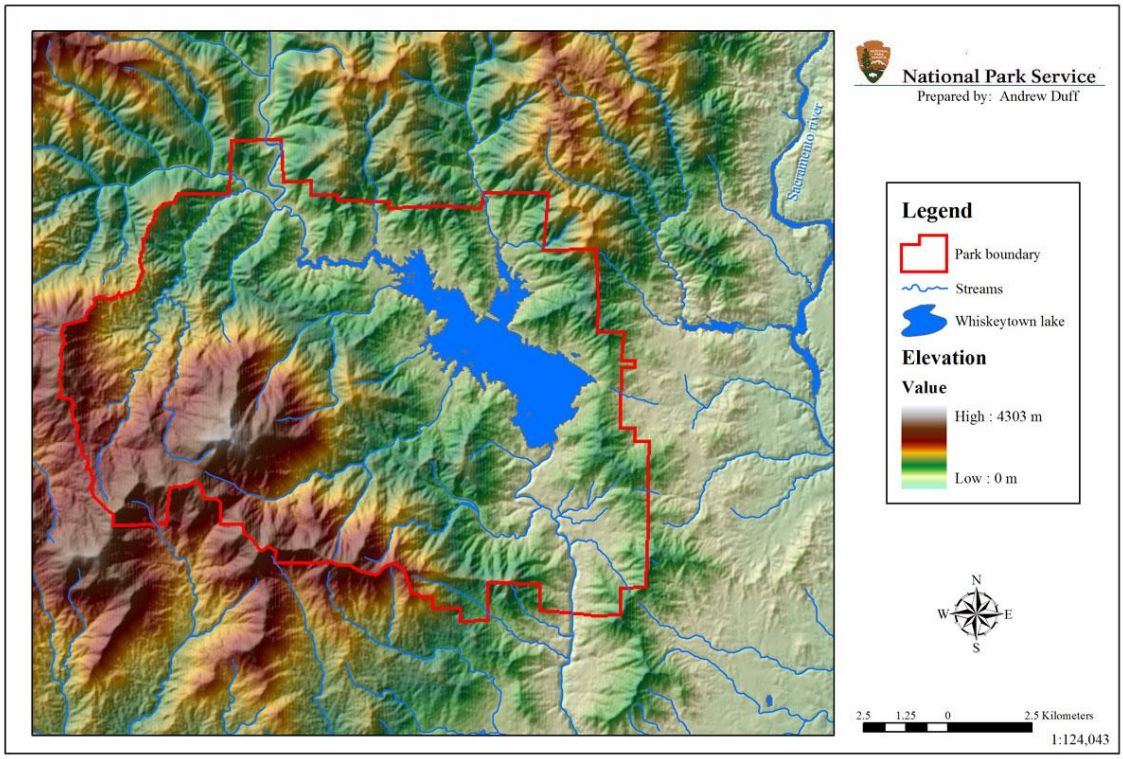
The Redwood National and State Parks lack information about the marine plants and animals in tidepools and other intertidal communities. In order to preserve and manage this unique marine ecosystem, an inventory of the resources needs to be completed. To protect their marine resources, the parks will continue to work closely with the California Department of Fish and Game to modify existing regulations that apply to offshore waters within park boundaries and in overlapping areas of special biological significance. The parks also cooperate with other federal and state agencies to protect marine mammals and seabirds and their nesting sites. Additionally, the potential impact from offshore ship traffic is a concern because major oil or hazardous material discharge from this activity can pose a serious threat to the parks' marine resources.

Second Growth Forests

The old growth redwood forests are the primary resource and purpose for establishment of these parks. The over 20,235 ha (50,000 acres) of second growth forests, however, are still recovering from timber harvest that occurred before establishment of a national park. The majority of these forests lack multi-canopy structure, composition, density, and understory vegetation common in old growth forests. Most of these degraded forests are overstocked with Douglas-fir and exotic species. The lack of a second growth management plan has hindered development of alternatives and prescriptions to restore

processes and forest conditions necessary for re-establishment and perpetuation of old growth forests. Without active management, a significant portion of the park's forest will remain degraded for many years.

1.6. WHISKEYTOWN NATIONAL RECREATION AREA



A. General Description

Location, Size, and Elevation

Whiskeytown National Recreation Area is a unit of the Whiskeytown-Shasta-Trinity National Recreation Area (NRA). It is located in Shasta County, at the northern end of the Sacramento Valley, 137 km (85 miles) inland from the Pacific Ocean, and 13 km (8 miles) west of the city of Redding, California. It can be reached from both the east and west by California State Route 299. Most of the park's 74 km (46 mile) boundary is bordered by private land, with some bordering lands administered by the Bureau of Land Management.

Whiskeytown encompasses approximately 17,198 ha (42,497 acres) of shrubland, oak woodland, and montane forest that surround the 1,416 hectare (3,500 acre) Whiskeytown Lake. The lake lies at the confluence of seven major streams, which not only provide drinking water for several municipalities, but also function as one of the largest watersheds feeding into the Sacramento River. The topography of the area can generally be described as steep hillsides in excess of 20 percent slope with high velocity watercourses. Elevations in the park range from 244 meters (800 feet) at the southern end of lower Clear Creek, to 1,893 meters (6,209 feet) at the summit of Shasta Bally. Whiskeytown's location within the Klamath Mountain physiographic province and proximity to the Cascade Mountains, Coast Range Mountains, and Sacramento Valley provides for a diversity of habitats. A broad range in elevation, rugged topography,

numerous soil types, and a history of natural and anthropogenic disturbance also contribute to its landscape heterogeneity.

Park Purpose and History

The Whiskeytown Unit of the Whiskeytown-Shasta-Trinity National Recreation Area is managed by the National Park Service. Whiskeytown's mandate includes protection and conservation of natural and cultural resources. The mandate is derived from the National Park Service Organic Act of 1916, which outlines the fundamental purpose of the National Park Service. The mandate also directs the National Park Service to allow for public use and enjoyment of national parks, provided that the resources therein remain unimpaired for future generations. The conservation of resources takes primacy over the provision of recreation, and all resource management activities must be consistent with this dual mission. The enabling legislation of Congress, which established Whiskeytown on November 8, 1965 under Public Law 89-336, provided specific responsibilities beyond this mandate. The park was to "provide...for the public outdoor use and enjoyment" of the specified reservoirs and surrounding lands "by present and future generations, and for the conservation of scenic, scientific, historic, and other values contributing to public enjoyment of such lands and water."

In addition to its natural diversity, Whiskeytown preserves a rich and unique cultural record of prehistoric and historic sites. The park's known cultural resources represent almost 8,000 years of use by native peoples. These resources document habitation sites with diverse artifact assemblages, middens, and in some cases housepits, seasonal camps, resource procurement sites, and what may be a spiritual site high on Shasta Bally with a view of Mount Shasta. Whiskeytown's historic resources exemplify a colorful history of the gold mining and lumbering era. These resources include historic water ditches and flumes, sawmills and stamp mills, stumps, tailings piles, abandoned mines, trash dumps, homesteads, the Camden House, Tenant House, and historic gravesites.

Climate

The climate in Whiskeytown varies considerably with the seasons and elevations. At low elevations, summers are hot and dry, and winters are cool with occasionally heavy rainfall. Temperature readings over 37.8° C (100° F) occur often during the months of May through October, with occasional sub-freezing temperatures from November through March. The average annual precipitation is 1524 mm (60 inches). Seventy-five to ninety percent of the total annual rainfall occurs between November 1st and April 30th. Reliable figures on snowfall are not available; however, snow often remains at the highest elevations well into June.

B. Biological Resources

In viewing the landscape around the Whiskeytown area, one is struck by the patchiness of the vegetation as it supports a diverse assemblage of plant and animal communities. Up

to twenty-seven habitats have been described in seven plant communities. These seven plant communities intergrade with one another in such a way that distinct boundaries between them are rare. This reflects a history of natural and anthropogenic disturbance in relation to edaphic and topographic features. Anthropogenic disturbances associated with mining, logging, and changes caused by the suppression of wildland fire or efforts to suppress fire have had the most powerful impact on the health and sustainability of Whiskeytown's plant and animal communities.

Vegetation and flora

The mixed conifer plant community occurs within elevations ranging from 914 to1893 meters (3,000 to 6,210 feet) and is primarily comprised of a mixture of co-dominant tree species. These species are Ponderosa pine (*Pinus ponderosa*), incense-cedar (*Calocedrus decurrens*), Douglas-fir (*Pseudotsuga menziesii*), sugar pine (*Pinus lambertiana*), and white fir (*Abies concolor*). Sub-communities that are less dominant, but locally plentiful, include red fir (*Abies magnifica var. shastensis*) and Jeffrey pine (*Pinus jeffreyi*). Below 914 meters (3,000 feet), the ponderosa pine forests are interspersed with mixed oak woodlands. Black oak (*Quercus kelloggii*) is co-dominant in many areas, with Douglas-fir, canyon live oak (*Quercus chrysolepsis*), and other scattered hard and softwood species that are present to a lesser extent.

The knobcone plant (*Pinus attenuata*) community can be found throughout the park at elevations below 610 meters (2,000 feet) as it intergrades with the ponderosa pine forest, mixed oak woodland, and chaparral plant communities. This community has a sparse overstory, which is sometimes co-dominated by black oak, canyon live oak, grey pine (*Pinus sabiniana*), and scattered ponderosa pine. Mixed oak woodland communities are scattered throughout the park at elevations up to 1219 meters (4,000 feet). Some of these communities are dominated by black oak with scattered ponderosa pine and other hardwood and conifer species. Associated species include Douglas-fir, ponderosa pine, and canyon live oak. Other oak communities are dominated by canyon live oak and interior live oak (*Quercus wislizenii*).

Whiteleaf manzanita overwhelmingly dominates the dense, impenetrable chaparral communities below 1219 meters (4,000 feet). Chamise (*Adenostoma fasiculatum*), toyon (*Heteromeles arbutifolia*), buck brush (*Ceanothus cuneatus*), yerba santa (*Eriodictyon californicum*), and poison oak are represented in these communities to varying degrees. Also, oak and pine species are sparsely distributed throughout. In dense chaparral, a deep thatch of leaf litter and downed woody debris prevents the establishment of other plant species. There is a montane manzanita chaparral community that is dominated by greenleaf manzanita (*Arctostaphylus patula*) that exists on granitic soils between 914 and 1800 meters (3,000 and 6,000 feet).

Unlike the other plant communities of Whiskeytown, the blue oak (*Quercus douglasii*) grasslands appear to have distinct boundaries that can be found between 335 and 914 m (1,100 and 3,000 feet). These blue oak grasslands primarily have an understory of annual

and perennial grasses, including a significant abundance of exotics such as starthistle (*Centaurea solstitialis*).

Riparian plant communities cover approximately ten percent of the park and vary in species composition and vegetation structure depending on elevation, aspect, and water source. There is little information on the vegetation of these riparian communities, but they can generally be described as closed-canopy canyon bottoms and ravines that are covered with canyon live oak, miner's dogwood (*Cornus sessilis*), black locust (*Robinia psudocacia*), bigleaf maple (*Acer macrophyllum*), and scattered mixed conifers. In the more open-canopies with larger bodies of water, there is a willow-scrub plant association that is characterized by dense willow thickets (*Salix spp*.), self-heal (*Prunella vulgaris*), dock (*Rumex spp*.), Himalayan blackberry, and several exotic and native grasses. At higher elevations, white alder (*Alnus rhombifolia*), riparian forests line streams in deep, steep-sided canyons. These forests are accompanied by such species as bigleaf maple, western azalea (*Rhodedendron occidentale*), and miner's dogwood. Also, there is a distinct yew-willow riparian woodland that has a mix of California yew (*Taxus brevifolia)* and willows found around 1219 m (4,000 feet).

One of the most unique and ecologically sensitive areas within the Whiskeytown NRA is a complex of three noncontiguous mineral springs that occur along a 366 m (1200 foot) stretch of Willow Creek and Highway 299. Despite extensive surveys, this site contains the only known location in the world for *Puccinellia howellii* (Howell's Alakali grass), an obligate wetland grass species that appears to have specific microhabitat requirements for the alkali water that seeps from the skeletonized soils and rock outcrops. Aside from being critical habitat for *P. howellii*, this site has been recognized as a community of considerable importance to wildlife as the home of such animal species as the pacific fishers, band-tailed pigeons, and foothill yellow-legged frogs. The site is also a culturally significant area, and is listed by the State of California as a Significant Natural Area (SHA-41).

There are several sections of unlogged old-growth forest in the Whiskeytown NRA that constitute another ecologically sensitive area with unique aesthetic and natural resource values. These old-growth forests are representative of the forest that covered the mountain slopes prior to logging, and they provide an intact and relatively undisturbed habitat for flora and fauna that are threatened throughout the Klamath Mountains. The old-growth sections may be a close representation of desired future conditions in mixed-conifer and ponderosa pine forests. This unique environment provides habitat for federally-listed spotted owls, as well as a number of plants that require moist, well-developed soils, including bride's bonnet (*Clintonia uniflora)*, phantom orchid *(Cephalanthera austinae)*, and twinflower *(Linnaea borealis* ssp. *longiflora)*.

One small section at the summit of Shasta Bally presents perhaps the only example of the dry subalpine meadow community found in the park. The area is ecologically sensitive and highly susceptible to disturbance. It is located on the east side of the summit in a low area, surrounded by red fir, where deep snow accumulates in the winter. The melting snow provides water to the fine, porous, decomposed granite soil. Grasses, sedges, rushes, and small herbs cover the ground and a small patch of false hellebore *(Veratrum*

californicum var. *califonicum)* also grows here, in the wettest spot. This species is characteristic of the Wet Subalpine Meadow community that is common the Klamath Mountains (NDDB), but rare within the park. Other sensitive plants found here include Snow Mountain beardtongue (*Penstemon purpusii*), three-bract onion (*Allium tribracteatum*), clustered lady's slipper (*Cypripedium fasciculatum*), yellow triteleia (*Triteleia crocea*), and bog orchid *(Piperia unalescensis).*

An extensive inventory of the park flora and the collection of herbarium voucher specimens was initiated in 1986 by David Biek and completed with the assistance of the Shasta Chapter of the California Native Plant Society. Sixteen sensitive plants are known to occur in the park. Sensitive plant species are plants that are not officially listed as Threatened or Endangered by the State of California or the federal Endangered Species Act, but that warrant consideration and protection due to limited distribution, scarcity of individuals, or the likelihood of becoming Threatened or Endangered. There are no known state or federally listed threatened or endangered plants in the park.

Fauna

Whiskeytown supports an abundant and diverse wildlife community, which reflects the numerous vegetation communities in the park. More than 200 vertebrate species are known to occur in the park, including at least 35 mammal species, 150 bird species, and 25 reptile and amphibian species. Additional species are likely to be confirmed in the park as wildlife inventories become more complete. The perpetuation of relatively intact wildlife populations within the park is partially dependent on the ability of public and private land managers to ensure that adequate habitat is protected in and around the park boundary.

Whiskeytown supports populations of four animal species that are federally listed as threatened: the southern Bald Eagle (*Haliaaeetus leucocephalus*), the Northern Spotted Owl (*Strix occidentalis caurina*), spring-run chinook salmon (*Oncorhynchus tshawytscha*), and Central Valley ESU steelhead trout (*Onchorynchus mykiss*). Bald Eagles were first documented as nesting at Whiskeytown Lake in 1973. There are currently two nesting pairs of bald eagles at Whiskeytown, as well as a substantial wintering population.

A single pair of nesting Northern Spotted Owls with two fledglings was discovered in the summer of 1994. The owl activity center has been be monitored annually since that time and records are kept that detail nesting location, status, and productivity. This activity center has successfully produced young during three of the last seven years. Spotted owl surveys are ongoing and eventually all suitable habitat within the park will be surveyed. It's possible that additional pairs of northern spotted owls will be discovered since suitable habitat exists in other, more remote areas of the park.

The removal of McCormick-Saeltzer Dam on lower Clear Creek in the Fall of 2000 has allowed access for spring-run chinook salmon (*Oncorhynchus tshawytscha*) and Central Valley ESU steelhead trout (*Onchorynchus mykiss*) to the park. These anadramous fish are now using portions of lower Clear Creek within Whiskeytown for spawning.

Spawning gravels are being added to Clear Creek below Whiskeytown Dam to enhance this habitat.

The park also contains four federal "Species of Concern." Those species are: foothill yellow-legged frog (Rana boylei), northwestern pond turtle (*Clemmys marmorata marmorata*), pacific fisher (*Martes pennanti pacifica*), and the pacific western big-eared bat (*Corynorhinus townsendii townsendii*).

Whiskeytown also contains several species with California state status but no federal status. The bank swallow (*Riparia riparia*), a California threatened species, has been observed several times within the park by members of the local Audubon Society and is probably a rare summer resident. The following species that are found at Whiskeytown are on California's list of "Species of Special Concern:" Cooper's hawk (*Accipiter cooperii*), sharp-shinned hawk *(Accipiter striatus*), osprey (*Pandion haliaetus*), yellow-breasted chat (*Icteria virens*), yellow warbler (*Dendroica petechia*), common loon (*Gavia immer*), California gull (*Larus californicus*), double-crested cormorant (*Phalacrocorax auritus*), pallid bat (*Atrozous pallidus*), and merlin (*Falco columbarius*). Additional species that are on federal or state lists may be discovered within the park as wildlife inventories become more complete.

C. Earth and Water Resources

Geological resources of Whiskeytown NRA include the narrow, deep, Clear Creek canyon below Whiskeytown Dam, which exposes the oldest of the park's rock formations, the igneous Copley Greenstone. The geology and soils in the park are typical of the southern Klamath Mountains geologic province. Copley Greenstone overlays Balakala rhyolite, which is overlain by sedimentary layers. These are partially intruded by the Shasta Bally batholith, which is composed of biotite quartz diorite, a granitic rock, and forms the mountains in the southern and western part of the park. The soils of this batholith area are derived from the decomposition of the granitic rock. Decomposed granite is extremely friable and subject to erosion. Heavy logging in the past has left some slopes bare and restoration efforts are difficult. The bedrock underlying the park is extremely tilted, folded, and fractured. Metamorphosed sections of these rocks are generally ore bearing, and have produced copper, zinc sulfides, talc, pyrite, gold, and silver.

Whiskeytown Lake was created by the blockage of Clear Creek by the Clair A. Hill Whiskeytown Dam, built by the Bureau of Reclamation (BOR) in 1962. The lake contains 1304 ha (3,220 acres), or 240,000-acre feet, of water at full capacity, and provides recreation for 800,000 visitors annually. It also serves as the domestic water supply for the cities of Redding, Old Shasta, Centerville, Keswick, and Happy Valley, and is one of several lakes that store water for the Central Valley Project. Seven major streams empty directly into the lake: Clear Creek, Mill Creek, Brandy Creek, Crystal Creek, Boulder Creek, Willow Creek, and Whiskey Creek. Intermittent streams abound throughout the park, and many springs that are found at higher elevations significantly affect microclimates.

D. Resource Management Concerns

Recreation Use

Whiskeytown attracts approximately 800,000 visitors per year. Recreational activities in Whiskeytown include boating, swimming, water skiing, sailing, scuba diving, bird watching, fishing, hunting, hiking, horseback riding, mountain biking, camping, picnicking, gold panning, off-road vehicles, and NPS interpretive programs. The population of Redding has grown from 16,000 to 80,000 in the last 20 years, and encroachment on habitat near the park has occurred. It is expected that as visitor use increases, so will encounters with wildlife. Bear-human incidents and mountain lion-human incidents are of particular concern to land managers.

Land Use Impacts

Prior to the establishment of the park, resource extraction and development impacted the resources of the park's watersheds. Mining resulted in numerous dredge tailing piles, furrows in and around creek beds, and sedimentation of creeks, as well as numerous pits, adits, tunnels, scars, and old roads and trails. Massive amounts of gravel were extracted, and gravel extraction continues currently in the lower reaches of Clear Creek. Logging has occurred on most commercially valuable timberland and most old logging roads and landings interfere with natural drainage patterns and revegetation. The south-central portion of the watershed is dominated by a huge granite batholith, which contributes significant amounts of decomposed granite to creeks and Whiskeytown Lake as a result of past logging practices. Some decomposed granite makes its way into lower Clear Creek via the South Fork of Clear Creek. The increased sediment decreases anadromous fish-spawning habitat, as well as habitat for insects on which fish feed. In an effort to comply with the Central Valley Improvement Act and improve anadromous fish habitat, the NPS has implemented an active watershed restoration program to reduce sedimentation of the Whiskeytown watershed. However, according to the General Management Plan for the NRA, the park has insufficient information regarding its water resources, including identification and description of surface waters, springs, and seeps, the amount of water flowing from these sources, and the quality of the water.

Aside from the effects of mining and timber harvests, the suppression of fire has resulted in a deterioration of ecosystem health that threatens the fire-adapted plant communities of Whiskeytown. There is no question that the increase in tree density, late successional species, and landscape homogeneity that results from fire suppression threatens the stability, diversity, and resilience of mixed conifer forests. Thus, this practice essentially ensures the destruction of our forests by a twentieth-century fire regime that is composed of large catastrophic crown fires, either alone or in combination with large insect and disease epidemics.

Exotic Invasive Plants

Whiskeytown is host to approximately 170 exotic plant species, which account for approximately 25 percent of the plants in the park. The most troublesome exotic species at this time in terms of invasiveness are tree of heaven (*Ailanthus altissima)*, yellow starthistle (*Centaurea solstitialis*), Scotch and French broom (*Cystisus scoparius* and *Genista monspessulana*), and Himalayan blackberry (*Rubus discolor)*. Several areas have been successfully treated and control efforts for the next several years are expected to achieve a significant reduction in exotic plant populations in the park. Treated areas will require monitoring and re-treating indefinitely. The NRA works cooperatively with the Shasta County Weed Management Area to eradicate exotics across the boundaries of the park.

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